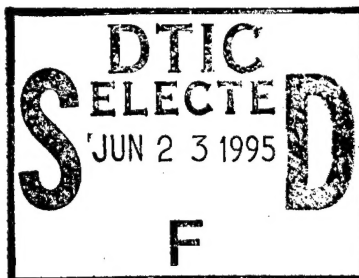


ASC-TR-95-5004

ANALYSIS FOR INTEGRATED DEVELOPMENT
PLANNING: INDUSTRY AND GOVERNMENT ROLES



ASC/XR BLDG 16
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WRIGHT PATTERSON AFB OH 45433-7227

NOVEMBER 1994

FINAL REPORT FOR 09/27/94-11/14/94

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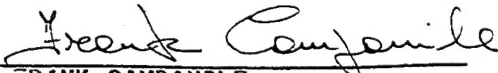
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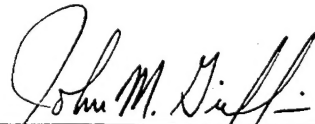
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This technical report has been reviewed and is approved for publication.


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REPORT DOCUMENTATION PAGE			Form Approved OMB No. 0704-0188	
Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188), Washington, DC 20503.				
1. AGENCY USE ONLY (Leave blank)	2. REPORT DATE NOV 1994	3. REPORT TYPE AND DATES COVERED FINAL 09/27/94--11/14/94		
4. TITLE AND SUBTITLE ANALYSIS FOR INTEGRATED DEVELOPMENT PLANNING: INDUSTRY AND GOVERNMENT ROLES		5. FUNDING NUMBERS C PE PR TA WU		
6. AUTHOR(S)				
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) AERONAUTICAL SYSTEMS CENTER AIR FORCE MATERIEL COMMAND WRIGHT PATTERSON AFB OH 45433-7126		8. PERFORMING ORGANIZATION REPORT NUMBER		
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES) AERONAUTICAL SYSTEMS CENTER AIR FORCE MATERIEL COMMAND WRIGHT PATTERSON AFB OH 45433-7126		10. SPONSORING/MONITORING AGENCY REPORT NUMBER ASC-TR-95-5004		
11. SUPPLEMENTARY NOTES				
12a. DISTRIBUTION/AVAILABILITY STATEMENT APPROVED FOR PUBLIC RELEASE; DISTRIBUTION IS UNLIMITED.		12b. DISTRIBUTION CODE		
13. ABSTRACT (Maximum 200 words) The Government/Industry Integrated Development Planning Process Action Team (PAT) was chartered by Lt Gen Fain, Commander of ASC, to identify and investigate methods to increase industry's involvement in the analysis portion of the development planning process. The first area of PAT activity determined the primary requirement is a closer integration of industry and government processes so that industry can plan for activities of the Technical Planning Integrated Product Teams (TPIPTs). The second area consisted of reviewing and refining the TPIPT's analysis processes and supporting analysis infrastructure. The third area concerned defining industry participation options. The path taken by the PAT was based upon the stipulation that the process must always be executable by the government. Industry participation was viewed as augmenting the basic government process. The process defined maintains the government's full control, permitting industry to participate at different levels of involvement and encouraging tailoring of the analysis process by the respective TPIPTs. In summary, the PAT found that it is beneficial and feasible for both the government and industry to integrate industry into the TPIPT analysis process. A follow-on PAT is needed to look at broader Air Force wide modernization issues and processes.				
14. SUBJECT TERMS TECHNICAL PLANNING INTEGRATED PRODUCT TEAM (TPIPT), DEVELOPMENT PLANNING, INDUSTRY, AIR FORCE MATERIEL COMMAND (AFMC), MISSION AREA PLANNING ANALYSIS, INTEGRATED			15. NUMBER OF PAGES 56	
			16. PRICE CODE	
17. SECURITY CLASSIFICATION OF REPORT UNCLASSIFIED	18. SECURITY CLASSIFICATION OF THIS PAGE UNCLASSIFIED	19. SECURITY CLASSIFICATION OF ABSTRACT UNCLASSIFIED	20. LIMITATION OF ABSTRACT SAR	

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EXECUTIVE SUMMARY

This report summarizes the activities and results of the Government/Industry Integrated Development Planning Process Action Team (PAT). The PAT was chartered by Lt. Gen. Fain, Commander of Aeronautical Systems Center, to identify and investigate methods to increase industry's involvement in the analysis portion of the development planning process. The two owners of the PAT were Mr. John Griffin, Director of Aeronautical Systems Center's Directorate of Development Planning (ASC/XR) and Mr. Brad Gale, National Security Industrial Association (NSIA) representative and Lockheed-Fort Worth, Director of Program Initiatives. The membership consisted of ten government personnel and ten industry representatives. The latter were chosen by the Dayton Chapter of the NSIA to represent a cross section of the industry -- airframe primes, propulsion, and avionics representatives. At the third meeting, representatives of two analysis companies were added to complement the original membership.

The Technical Planning Integrated Product Teams (TPIPT) have been created by the Air Force Materiel Command (AFMC) to support the MAJCOM and AF/XO Mission Area Planning Process. There are 21 TPIPTs across the four AFMC Acquisition Centers each integrated with a corresponding MAJCOM Mission Area Plan. The Appendix contains a complete list of individual TPIPTs and names of TPIPT chiefs.

Results

The government/industry Process Action Team explored multiple alternatives for integrating industry in the analysis portion of the development planning activity. The major activities and advantages of integrating industry were:

- (1) Dissemination of data and analysis plans to industry
 - Analysis plans & results
 - Technology & TPIPT activities
 - Involvement areas for industry
- (2) Refinements of the TPIPT process
 - TPIPT analyses
 - Infrastructure (databases, models, interfaces)
- (3) Definition of industry participation options and activity areas
 - 3 participation options
 - 9 interface activity areas

The first step to achieve a closer integration of industry and government is to disseminate planned activities of the TPIPTs and prior results to industry. It is envisioned that TPIPT leads will accomplish this through the use of Commerce Business Daily (CBD) announcements, industry advisory groups (such as NSIA), or other public media. The information provided to industry will include activity descriptions, goals and objectives, and criteria for industry participation. A fundamental element of TPIPT activity will be an annual analysis plan. This plan will provide industry with detailed information in order that industry may prepare proposed levels of involvement and be fully informed of the government's plans and priorities. The output of the TPIPTs is development plan for each TPIPT and a single integrated, Technology Investment Recommendation Report (TIRR).

The second major area of PAT activity consisted of reviewing and refining the TPIPT's analysis processes and supporting analysis infrastructure. Step-by-step processes and data flow diagrams were developed and documented. This information was then used to delineate separate government and industry activities and 9 areas for cooperative undertaking. The 9 areas are shown in Figure ES-1. The output of this activity provided a framework that will be tailored by individual TPIPT managers to describe specific conditions of interface and designated entry points for industry. The detailed process charts and interface activity areas are described in the Appendix.

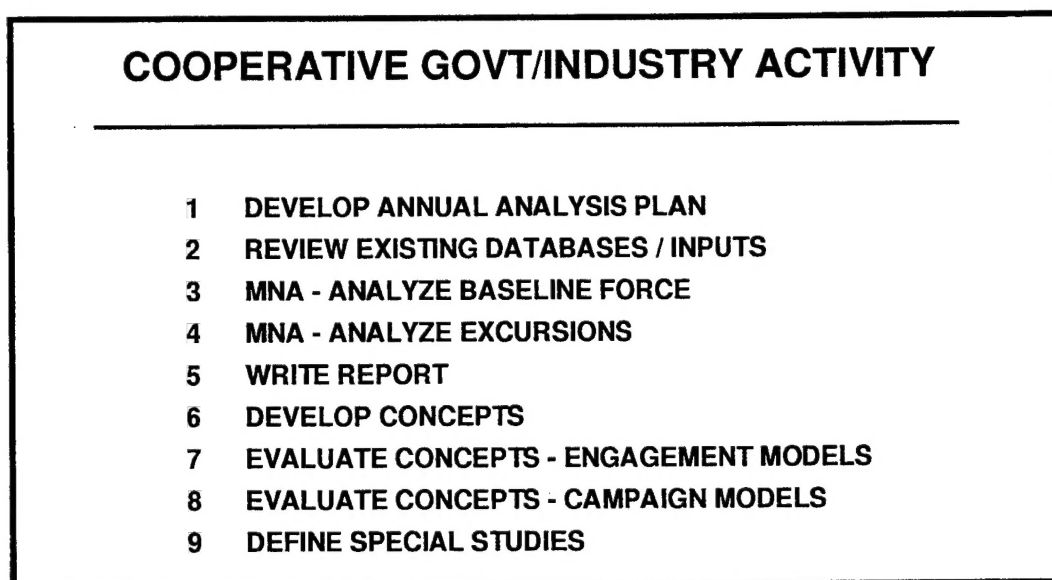


Figure ES-1 - Cooperative Government/Industry Activity

The third major area of PAT activity concerned defining industry participation options. Three options were defined (see Figure ES-2):

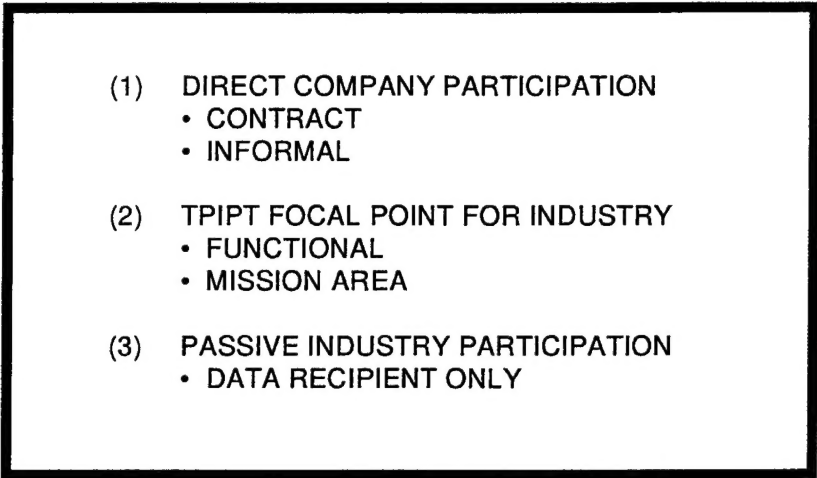
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- (1) DIRECT COMPANY PARTICIPATION
 - CONTRACT
 - INFORMAL
 - (2) TPIPT FOCAL POINT FOR INDUSTRY
 - FUNCTIONAL
 - MISSION AREA
 - (3) PASSIVE INDUSTRY PARTICIPATION
 - DATA RECIPIENT ONLY

Figure ES-2 - Government/Industry Participation Options

These options allow industry a full range of choices and provide industry the ability to tailor their activities on a TPIPT-by-TPIPT basis, consistent with their product lines and internal marketing objectives.

Implications to Industry

The government's goal to "put analysis behind investment strategy decisions" and to implement TPIPTs/MAPs as the core elements of the modernization planning process have significant implications to industry. These are summarized in Figure ES-3.

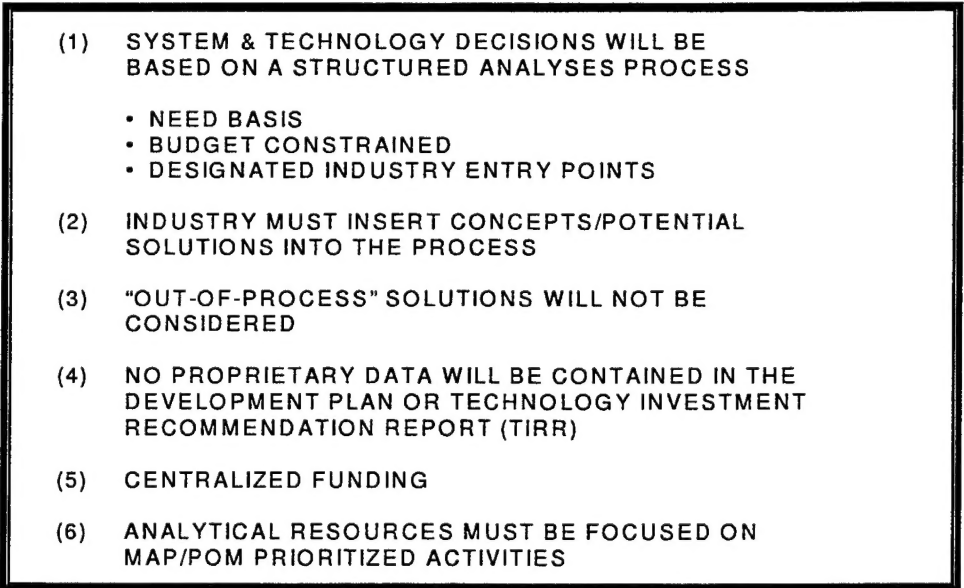
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- (1) SYSTEM & TECHNOLOGY DECISIONS WILL BE BASED ON A STRUCTURED ANALYSES PROCESS
 - NEED BASIS
 - BUDGET CONSTRAINED
 - DESIGNATED INDUSTRY ENTRY POINTS
 - (2) INDUSTRY MUST INSERT CONCEPTS/POTENTIAL SOLUTIONS INTO THE PROCESS
 - (3) "OUT-OF-PROCESS" SOLUTIONS WILL NOT BE CONSIDERED
 - (4) NO PROPRIETARY DATA WILL BE CONTAINED IN THE DEVELOPMENT PLAN OR TECHNOLOGY INVESTMENT RECOMMENDATION REPORT (TIRR)
 - (5) CENTRALIZED FUNDING
 - (6) ANALYTICAL RESOURCES MUST BE FOCUSED ON MAP/POM PRIORITIZED ACTIVITIES

Figure ES-3 - Implications to Industry

The emerging government modernization planning process will bring a focused and prioritized foundation to all Air Force modernization, and research and development activities. Industry's mode of operation will need to change in order to be an integral and contributing partner. It is anticipated that access to government plans, priorities and process involvement will enable industry to benefit by better focusing internal investment decisions.

Implications to Government

Enabling industry to participate in the modernization/development planning process will result in a significant set of implications to the government, foremost of which is a management challenge. This includes:

- (1) Operating and communicating without contracts, cooperatively, where government personnel cannot ask for or direct any industry tasking, to which they are accustomed.
- (2) Ensuring that activities are open to all, while keeping working groups and interface meetings to a manageable size. Activities include:
 - Identifying plans to industry
 - Identifying opportunities where industry can participate, when, and the kind of data necessary to participate
 - Making data and analyses available
- (3) Properly controlling all levels of classified data, including special access.
- (4) Providing feedback on all industry inputs not incorporated into final products.
- (5) Integrating across MAPs/TPIPTs to ensure the "integrated" product teams do not become "independent" product teams.
- (6) Developing analysis methodologies and analysis tools that are both fast to set up and quicker to operate. This type of infrastructure is essential to be responsive to TPIPTs, MATs, and other customers.
- (7) Eventually incorporating other AFMC Product Centers and other Services into the process so that joint plans and recommendations are taken forward, ultimately to the JROC and Congress.

Benefits to the Government

Assuming the government can successfully meet the management challenges, the list of potential benefits is also substantial:

- (1) There is a defined way and time for industry to enter the TPIPT process.
- (2) MAP Teams will be able to benchmark model outputs and standardize inputs, groundrules and assumptions, threat laydowns, scenarios, mission profiles, concepts of operations, etc.
- (3) The total analysis and planning activity will become more robust through the addition of completed industry analysis and other information.

- (4) Industry can help reinforce study results, help build consensus, and show agreement as the Services try to defend future programs and budgets.
- (5) Industry will be better able to focus their IR&D activities against defined high priority needs or against potential high-leverage targets of opportunity, i.e., “leap-frog” type capabilities.

Conclusion

The path taken by the PAT was based upon the stipulation that the process must always be executable by the government. Industry participation, although desirable and valuable, was viewed as augmenting, broadening or deepening the basic government process. The PAT was cognizant of the fact that different companies may choose to participate at different levels, at different times in different TPIPTs, depending upon their individual business goals and interests. The process defined is amenable to these variations, maintaining the government’s full control of the process, permitting industry to participate at different levels of involvement at different times throughout the process, and encouraging tailoring of the analysis process by the respective TPIPTs to meet the unique needs of the assigned development plan.

The PAT was concerned that the way the Air Force currently conducts modernization planning has several shortcomings, as noted on the top half of Figure ES-4. The situation makes R&D and the service’s programs vulnerable to Congress and staffers. This PAT developed an end-state vision of the evolving planning process as noted in the bottom half of the figure. This PAT suggests that a subsequent PAT develop a comprehensive vision and implementation plan for future, integrated modernization planning, paying particular attention to the service needs, the Pentagon and Congressional issues as well as connectivity to Air Force Materiel Command’s Air Logistics Centers and Product Centers.

MODERNIZATION PLANNING

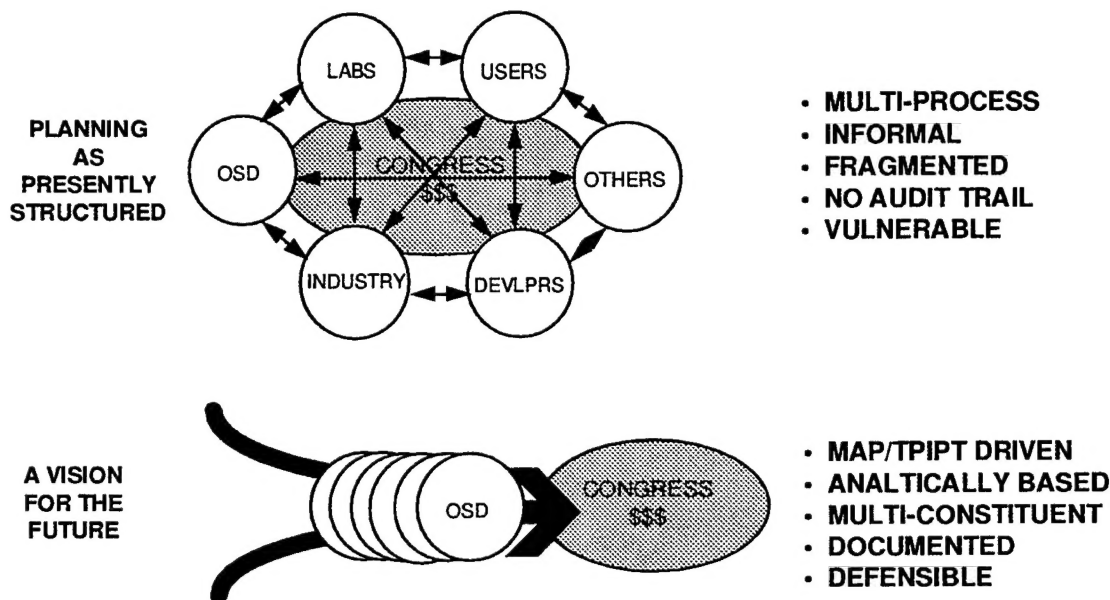


Figure ES-4 - Modernization Planning

In summary, the PAT found that it is beneficial and feasible for both the government and industry to integrate industry into the TPIPT analysis process. A follow-on PAT is needed to look at broader Air Force wide modernization issues and processes including the merging of all related modernization planning, funding of MAP and TPIPT activities and modernization thrusts.

1. BACKGROUND OF TPIPTS AND PAT-1

This government/industry Integrated Development Planning Process Action Team (PAT) was chartered by an action item from ASC President's Day, 18 Nov 93, to examine the development planning process and identify how government and industry could cooperate on the analysis phase of the TPIPT process.

1.1 PAT CHARTER

The Charter for the Process Action Team (PAT) was developed and issued during the initial meeting in February 1994. The official title of the PAT was: "Exploration of Alternatives for Integrating Industry in the Analysis Portion of Development Planning." The purpose of the PAT was for the representatives of government and industry to discuss and exchange data/information related to development planning. Emphasis was given to the quantitative, analysis-based aspects of the development planning process. The PAT was not chartered as a standing group. Meetings were held approximately once a month from February 1994 until September 1994.

Introduction: During ASC's 25 August 1994 Quality Symposium, Lt Gen Fain asked a panel of senior Air Force and industry people to take on the task of defining, and documenting industry's participation in the Air Force Modernization Process. As a result, an IPT was formed to address six action items (listed below) and report back to the panel who in turn will report to Lt Gen Fain and Company Presidents during Presidents Day, 10 November 1994 at ASC.

Action Items: Develop a vision of the Air Force Modernization Process and to what the Air Force is trying to accomplish.

Write a white paper fully explaining the Air Force Modernization Process.

Develop a prioritization process for both deficiencies and concepts.

Develop a plan to gain the necessary advocacy.

Develop a plan to obtain necessary funding.

Document the benefits to program executives of a documented "bought-into" acquisition process.

Plan/Deliverables: To be developed by PAT-2.

Exit Criteria: To be developed by PAT-2.

Schedule:	Initial IPT Meeting	27-29 September 1994 (WPAFB)
	Interim Briefing to Panel	TBD
	Follow-up IPT Meeting	26-27 October 1994 (TBD)
	Follow-up briefing to Panel	TBD
	Briefing to Lt Gen Fain & Presidents	10 November 1994

1.2 FEDERAL ADVISORY COMMITTEE ACT (FACA) ISSUE

Potential conflicts with the Federal Advisory Committee Act (FACA) were addressed at the first meeting. The intent of the PAT was that it not be an advisory committee. The Federal Advisory Committee Act (FACA), Public Law 92-463, defines an advisory committee and imposes certain restrictions on its conduct.

An "Advisory Committee", as defined in the FACA, means any committee, commission, council, conference, panel, task force, or other similar group, which is established or utilized by one or more agencies in the interest of obtaining advice or *recommendations* for agencies or officers of the Federal Government.

If an "advisory committee" is deemed to exist per the above definition under FACA, then FACA applies. If FACA is applicable, then the Congress has to charter formally the advisory committee and be informed in detailed reports on the number, purpose, membership, activities and the cost of such "advisory committee" on a regular basis. The General Services Administration would have oversight responsibility as well as the agency in which the committee resides. No meetings are permitted to be held and no action is taken until the charter is filed with the agency head to whom it reports and with the standing Committee of the Senate/House having legislative jurisdiction of such agency.

Based on the Statement of Purpose in the Charter, this Government/Industry PAT was not deemed to be subject to the FACA. The stringent rules dictated by the FACA; therefore, did not apply. Continuous self-monitoring by all PAT members throughout the life of the PAT ensured compliance.

1.3 SELECTION OF MEMBERS

The membership of the PAT was developed in two phases. The initial phase identified team members for the kickoff meeting. The initial group which met on 8 Feb 94 at the kickoff meeting was intentionally a mix of program managers, planners, lawyers, and procurement people. This diversity was to provide different perspectives relative to the PAT's tasking -- i.e., form an Integrated Product Team to identify options for industry involvement in the analysis phase of the TPIPT process. After the development of the charter and the clarification of the legality of the group, the PAT members decided that to meet the objectives of the PAT, the industry membership needed to be expanded beyond hardware developers/manufacturers to include representatives from "study houses". A complete list of the final members of the PAT is contained in the Appendix.

1.4 OBSTACLES/RESOLUTIONS

Once the PAT worked through the initial concern on conflicts with FACA, the major obstacles encountered by this PAT were (1) identification of common goals, (2) terminology and process definitions and (3) understanding of the TPIPT process.

The PAT easily overcame identification of a common goal because all members were very supportive of the increased involvement of industry in the analysis portion of the TPIPT process. The government representatives were interested in obtaining the industry perspectives, ideas and analysis experience base. Industry was interested in a process that would put them in a better position to understand, offer alternatives, and identify future investment opportunities. Thus, the PAT was able to focus quickly on the PAT charter, i.e., identification of opportunities for industry involvement in the analysis portion of the new Technical Planning Integrated Product Team (TPIPT) process.

With a clear focus on direction of the PAT, the next obstacle became the issue of common terminology and process definitions or, more correctly, understanding the TPIPT process. The obstacle involved developing an understanding of the new integrated product teams, such as the TPIPTs used by AFMC's Development Planning organizations, the Technology Thrust Integrated Product Teams (TTIPT) used by the AFMC laboratories and the Customer Focus Integrated Product Teams (CFIPT) -- their functions, processes, products, etc.

To overcome this obstacle, the PAT was presented a series of briefings and discussions on the overall modernization process and how the TPIPT process interacts with it. The PAT analysts and technologists then developed a process flow chart to identify where/how industry might be able to fit into the analysis portion of the process. After these briefings and the flow charting, the PAT was able to understand the TPIPT process well enough to begin working on how industry could participate and where in the process that participation would best benefit both government and industry.

This delay in PAT members understanding the underlying process provides a valuable lesson to be learned -- prepare tutorial material to be presented at the initial meeting(s) to enable members to develop quickly an understanding of the terms and the direction of the PAT.

1.5 TPIPT HISTORY

Technical Planning Integrated Product Teams (TPIPT) evolved from a concept for integrating development planning and technology planning within the Development Planning Directorate at Eglin AFB. Development planners from XR and technology planners from what was then called the Air Force Armament Development Lab (now an element of Wright Labs at Wright-Patterson AFB), needed an effective means to work together to develop and evaluate concepts for new munitions systems. This integration of a small number of development planners, technology planners and engineers, and representatives from the operational command (Tactical Air Command at that time) was called a Technical Oversight Committee (TOC). TOCs were operated very successfully at Eglin AFB for several of the weapons areas (air-to-surface munitions, air-to-air munitions, etc.) When General Yates, then Commander of Air Force Systems Command, visited Eglin AFB and was provided an overview of the TOC operations, he was impressed with the successes and cooperative interaction of the AFSC team members. He was especially impressed with the manner in which the teams involved the operational command representatives in the concept design and evaluation process. General Yates decided that TOCs should be implemented for all mission areas at each AFSC product center and directed the centers to implement the concept.

The original concept of a TOC was to have a small core (3 to 5 people) of development planners in the XR organization of the AFMC product centers for each major mission or functional area. This core of people was to be supplemented by experts in many areas, either by telephone contact or by permanent or part-time co-location. Areas to be represented were technology, operational commands, logistics, testing and the Systems Program Offices. This "team" would meet periodically to understand operational deficiencies, develop concepts to resolve those deficiencies, evaluate the potential effectiveness of the concepts, identify available or evolving technologies to use in the concepts and to provide guidance to the laboratories on what additional technologies needed to be developed or to support currently needed technologies. The permanent "core" planners would keep the process going on a day-to-day basis.

Soon after the implementation began, the name was changed several times. The first change was to call the team a Technical Oversight Group (TOG). The "oversight" portion of the name was then changed to reflect the fact that these teams did not actually "oversee" technology development but only provided information and recommendations to the labs to help guide the technology developments. The

word "planning" was substituted for "oversight", reflecting the true nature of the work accomplished by these teams, and the "groups" were called "teams". Implementation of Technical Planning Teams continued when Systems Command and Logistics Command were integrated into Air Force Materiel Command. Major General Fain became the first Director of Requirements (AFMC/XR) in the new command. General Fain, after reviewing the policy development for TPIPTs, proclaimed the teams had basically the same conceptual purpose as Integrated Product Teams which were also being implemented throughout the command and changed the name to the current Technical Planning Integrated Product Team (TPIPT). Section 2 discusses TPIPTs in detail.

2. TPIPTS AND THE PAT

2.1 TECHNICAL PLANNING INTEGRATED PRODUCT TEAMS

“Strategy-to-Task” is a phrase that is the cornerstone of the Air Force Modernization Process. The meaning reflects a comprehensive end-to-end planning process. A more complete description of the entire end-to-end process is embodied in the phrase “Strategy-Task-Need-Concept-Technology” (S-T-N-C-T). The key elements of the process are:

- a. Strategy-to-Task (S-T): Comprehend the national strategies of the United States and of DoD. Reduce them to unique tasks attributable to specific mission areas.
- b. Task-to-Need (-T-N-): Determine the strengths and shortfalls associated with each mission area. Call out the task shortfalls as “needs” and prepare Mission Needs Statements, if applicable.
- c. Need-to-Concept (-N-C-): Prepare notional system concepts to solve the needs (i.e., task deficiencies). Develop plans for each Mission Area.
- d. Concept-to-Technology (-C-T): Identify and access technologies associated with the high payoff concepts.

Key functional groups in the S-T-N-C-T process include the Mission Area Teams (MAT) and the Technical Planning Integrated Product Teams. The MATs are responsible for preparing the Mission Area Plans (MAP). The TPIPTs provide a supporting mechanism for developing and evaluating concept solutions and for linking the potential solutions through the AFMC Technology Master Process with the technology providers.

The AFMC Technology Master Process Handbook describes the responsibilities of TPIPTs as follows:

“AFMC has the responsibility for total life cycle systems management. Inherent in that responsibility is the ability to develop and introduce advanced technologies into both current and future systems. The TPIPTs contribute to the AFMC task by identifying and prioritizing technology needs within mission areas. Each TPIPT is assigned specific functional or mission areas of responsibility and support decision makers through development plans and proposed investment strategies. Each TPIPT will also serve as the functional area focal point for user needs.”

To accomplish their functions, the TPIPTs are comprised of personnel from all parts of the S-T-N-C-T process. The Development Planning (XR) organizations provide leaders and “home offices” for the TPIPTs. The other TPIPT members are empowered to represent their organizations in the TPIPT

activities. So far, industry has not been included as an integral TPIPT participant, though the desire is to include industry where applicable in the future.

Another important function of the TPIPTs is to serve as a linkage between the Air Force Modernization Process and AFMC's Technology Master Process. As a companion to the TPIPTs, the Center Technology Councils (CTCs) generate Technology Needs (TN) for infrastructure requirements. Due to the involvement of the Air Logistics Centers (ALCs), Test Centers (TCs), and System Program Offices (SPOs), the TPIPTs often address variants of the infrastructure TNs (e.g. Reliability, Maintainability and Supportability for a specific weapon system). The TPIPTs facilitate the Technology Master Process by guiding the labs, centers, and industry to develop, acquire, or insert technology.

The TPIPTs support the Air Force Modernization Process in a complex cycle. Mission Area planning occurs annually, and so TPIPTs receive the deficiencies (i.e., Task-Needs) every year and develop concepts to solve the deficiencies. However, the Program Objective Memorandum (POM) is prepared every two years, with updates in the off-years. Throughout the cycle, the TPIPTs are actively performing mission area studies and analyses, mission modeling and simulation, and concept formulation and assessment studies. Industry is doing the same activities in support of its IR&D and product development investment decisions. Thus, these types of activities are suitable for government/industry cooperation.

Figure 2-1 illustrates the Air Force Modernization Planning Process. The elements of this complex process which are the responsibility of TPIPTs are identified. In conclusion, the TPIPTs provide important support to Air Force modernization. They are primarily responsible for the Concept-Technology planning portion of the S-T-N-C-T process, and are supportive of the other portions. The result is a strong linkage between the system users and the system and technology developers; and as the process matures, will provide a link and system justification for the Air Force POM.

for Milestone 0 decisions -- decisions to spend money on *studies* of alternative concepts for improving our military capability through materiel means.

2.2.2 Mission Area Assessment (MAA)

The analyses should begin with a comprehensive examination of operations carried out with current systems, rather than with proposed new or improved systems, to quantify how much better or more likely we could achieve our overall objectives in the planning scenarios if we could perform certain operations better, without regard to the source of improvement.

The search for possible improvements must *first* focus on non-material solutions -- e.g. changes in doctrine and tactics -- which may lead to better wartime outcomes. A Strategy-to-Task analysis framework was developed by Glenn A. Kent, Lt. Gen., USAF (Ret) of the RAND Corporation as a viable means of defining and ranking operational tasks, deficiencies and evaluating concepts. This Strategy-to-Task methodology has been used very effectively to provide baseline estimates of current capability for each of the force elements.

2.2.3 Mission Need Assessment (MNA)

The acquisition directives require that "needs" be stated in terms of needed improvements in broad operational capability, and explicitly forbid narrowing down to a specific technical solution at this stage. Thus a "need" might be "to improve the capability to destroy armored columns on the march," not "a new airplane to destroy armored columns on the march."

This process of assessing the needs in a mission area requires some preliminary conceptual activity which examines in a very preliminary manner a broad range of plausible, general improvement concepts. Such conceptual activity need not be seen as particularly limiting, yet if it is properly performed, it will provide some help and basis for the decisions associated with Milestone 0. This activity need not and should not be particularly precise or detailed. The only hard requirements at this stage are that: (1) there be nothing apparent in the conceptual improvements that defy the known laws of physics, and (2) each conceptual improvement can be a part of at least one operational concept for performing an operational task, and that the operational concept(s) work from end to end, at least in principle.

2.2.4 Concept Development

Once the Mission Area Assessment and the Mission Need Analysis have been performed, deficiencies are identified by the failure to meet some operational objectives or to perform an operational task. If a deficiency in our planned baseline force is shown to occur, and it cannot be satisfied by a non-materiel solution, a Mission Need Statement (MNS) may be generated. These statements, at Milestone 0, set in motion the process of enhancing military capabilities. At this point, planners, analysts, engineers and technologists work together to formulate and define new operational concepts.

There are a multitude of ways to solve stated deficiencies. Improvements can occur on the platform, weapon, off-board assets or technology that enable changes in operational tactics or infrastructure enhancements. Improvements can also occur on existing assets, assets currently in Engineering and Manufacturing Development, or they can be new and even revolutionary concepts. What makes these concept definitions possible is the technologists identifying promising and maturing new technologies that have potential to be applied to the needed capability improvements. It is the bundling of these technologies along with the planned upgrades to current systems that enables the myriad of concepts to be conceived. Thus, planners, technologists and other members of the Technical Planning Integrated Product Teams (TPIPT) working with the MAP teams formulate, define and evaluate new operational concepts. This group also defines and pursues proof-of-principle concept demonstrations of the more promising concepts. This activity can consist of the Phase 0, concept exploration, in the acquisition cycle. The output of Phase 0 can provide the basis for a Milestone I decision; a decision to develop and acquire the systems to implement the selected operational concept(s). Using the TPIPT process and the analytically based Strategies-to-Task framework yields concepts that are viable and sound, and most important, defensible.

2.2.5 Concept Evaluations

Once concepts have been identified from the Concept Development step, each concept is evaluated during the Concept Evaluation Phase. Every concept will have a top-level analysis of its cost and operational effectiveness. The result of these concept analyses is high, medium, or low payoff assessment of the concept against the specific deficiency being addressed. For promising concepts more in-depth studies would be conducted. A wide range of models could be used for these evaluations. Top-level, fast running models are important to use for screening many of the concepts effectively. This

top-level screening will identify those few issues or cases that require analysis using the detailed, high-fidelity (and long running) models. Figure 2-2 illustrates the hierarchy of analyses that can be conducted on concepts. Engagement/mission level and campaign level models, both fast-running (probably PC-based) models and the high-fidelity models, will be used extensively to evaluate the concepts. The engineering level models will be used to a lesser extent. A summary of each analysis is shown below:

Engineering Level Summary -- *The engineering level is concerned with estimating the performance of systems and with exploring alternatives for achieving or improving the level of performance. The estimates are expressed in terms of Measures of Performance (MOP). Cost estimates are usually also a part of this level's activity. The consequence of that performance (and cost) is generally examined at higher levels.*

Engagement Level Summary -- *The engagement level is concerned with estimating the effectiveness of systems (with stated levels of performance -- with little concern for how the performance was achieved) in various classes of engagements -- air-to-air, surface-to-air, and air-to-surface. Such engagements may result during the execution of concepts of operation for performing operational tasks in stated environments. The resulting estimates are called Measures of Effectiveness (MOE), and consist primarily of kills, losses, and aborts.*

Mission Level Summary -- *The mission level is concerned with probabilities of engagements of various classes and the likely initial conditions for those engagements, under stated environmental conditions against stated ground and air defense force dispositions. It is directly concerned with geography, kinematics, sensors, and the performance of surveillance and control system components. It is not concerned with the larger questions of which missions are appropriately undertaken, or of what enemy force dispositions are appropriate, but generates information necessary for these questions to be addressed at theater/campaign level.*

Theater/Campaign -- *Analysis at theater/campaign level is concerned with the cumulative long term effects of kills and losses on the outcome of theater level conflict of campaign duration. Information from engagement and mission levels is used to determine how forces should be used to achieve campaign objectives. Draw-downs of forces, movements of ground forces toward objectives, the force dynamics associated with attaining or losing air superiority, protecting ground forces from air attack, and so on are calculated. Outcomes, measured in units that bear some relationship to the overall objectives specified in the planning scenarios, are called Measures of Outcome (MOO).*

Figure 2-3 illustrates the attributes, uses and examples of this hierarchy of models and analyses.

In addition to the relative payoff assessment, promising concepts would also be evaluated by the TPIPT on two other criteria. The first criterion is the developmental risk involved in transitioning the technology needed into a usable system. The second criterion is the technological risk involved in maturing/producing a technology to be transitioned to the development stage.

Analysis and Model Hierarchy

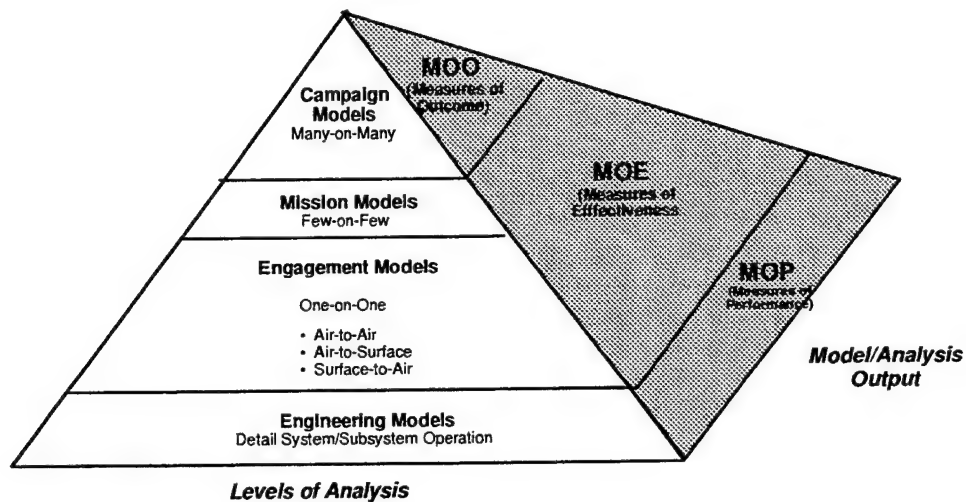


Figure 2-2 - Analysis & Model Hierarchy

	Theater/ Campaign	Mission	Engagement	Engineering
Force	Joint/combined forces and force elements as units, down through specific entities (individual aircraft, GCI site etc.)	Multi-platform, multi-tasking, shooter and support entities specified, then varied to cover range of probable forces	One to a few friendly entities vs: one to a few enemy entities for a specified class of engagement (air-to-air, etc)	Single weapon systems, subsystems, components
Environment	Initial geographic force dispositions (force laydowns and beddowns) and general environmental conditions provided in scenario specifications	Geographic force dispositions and environmental conditions specified, then varied to cover range of probable dispositions and conditions	Local force element locations and environmental conditions for engagement specified, then varied to cover range of probable conditions	Range of environmental conditions specified
Outputs	Measures of Outcome (MOO) -- related to campaign objectives	Probabilities of engagement under stated conditions	Measures of Effectiveness (MOE) -- e.g. kills, losses, aborts under specified conditions	Measures of Performance (MOP) -- performance of systems and subsystems -- radar range, sustained "g", etc. and Cost
Time Span Covered	Weeks-Days	Hours-Minutes	Minutes - Seconds	Months - Sub-seconds
Use	<ul style="list-style-type: none"> Top level eval of all system concepts Wargaming Battle Staff Training 	<ul style="list-style-type: none"> Usefulness of spatial deployments of systems Ingress/egress tactics development and evaluation 	<ul style="list-style-type: none"> Usefulness of system performance in engagements (effectiveness) Engagement tactics development and evaluation 	<ul style="list-style-type: none"> Engineering trades Engineering specifications Design
Example	<ul style="list-style-type: none"> Thunder 	<ul style="list-style-type: none"> Suppressor EADSIM 	<ul style="list-style-type: none"> Brawler ESAMS 	(Many)

Figure 2-3 - Attributes, Uses and Examples of Models Within Hierarchy

Through iterations of these evaluations, convergence on the estimated effectiveness, estimated costs of concepts and system requirements is achieved for the mission area studies. System requirements can also be defined and refined to aid the operational users in developing Operational Requirements Documents for any concepts to be considered for actual development. Technology efforts are modified in time, through technology maturation and engineering validation to focus against a specific deficiency better. System design of the concepts progresses from conceptual trade-offs that examine concepts and determine the contributions of technologies, through concept selection to preliminary design and classical system risk reduction activities, such as wind tunnel and structural element testing. The process is complete when all the information needed is available for an informed acquisition option selection by the operational command leaders.

2.2.6 Special Studies

The purpose of special studies is to examine concepts in much greater detail than the usual analysis supporting development of the Development Plan. These analyses use the development planning skills at AFMC Product Centers to *refine* the desirable characteristics of an operational concept for the weapon system, a major subsystem, or address specific issues such as reliability and maintainability. Since any "requirement" for a new concept is "tradable", the function of special studies is to perform the trade-off analyses necessary to establish the effectiveness, cost and possible risks of achieving certain desirable performance, system characteristics and system attributes. This process also assists the using commands in formulating the Operational Requirements Document (ORD) by establishing objective thresholds and goals for the desirable characteristics. Thus, these special studies and trade-off analysis are carried out to refine and hence, define better operational concepts for accomplishing designated military tasks and achieving stated military objectives. These studies employ some of the classical development planning skills to develop detailed conceptual system designs and continually refine those designs as the requirements trades enable the using command to define better what the system should be capable of doing and what the system will most probably cost.

Examples of special studies and tradeoff analysis are varied and numerous. For example, many trades can be performed by preliminary aircraft designers, on the characteristics of the operational concept's platform. Any of the measures of performance (MOPs) can be traded. These include speed, turn rate, energy maneuverability, weapon loadouts, observable and even configuration arrangements such as internal versus external weapon carriage. Detailed subsystems analysis can also be performed

such as engine cycles and avionics performance such as radar or other sensor range. Many of these trades affect the platform weight and hence cost. These trade-off analyses are also performed within the context of the various operational constraints that may be imposed. These include weight and size restrictions that are outcomes of carrier suitability, aircraft shelter size and other constraints. The final result of these special studies and trade-off analyses are detailed conceptual designs and refined requirements that enable the using command to write an effective ORD and if the System Program Office is already formed, for it to provide the basis to begin writing the specifications to develop and acquire the needed system. This methodology ensures the requirements for a new system or upgrades are based on a *disciplined* and *documented* process that is *defensible*.

2.2.7 Products And Documentation

The final step of this disciplined process is to compile all of the analyses results into a completely documented report. The document(s) are published annually as a “snapshot in time” to support defense of the AF POM created by the Modernization Planning Process. The document(s) should be published and disseminated to every organization that participated in the process as well as to the people who make the decisions on where resources are allocated.

Currently two important documents are developed, a Development Plan from each TPIPT and a Technology Investment Recommendation Report (TIRR) from each of the AFMC Product Centers. There are currently 21 TPIPTs in the four AFMC Product Centers as shown in Figure 2-4. A listing of the TPIPT functions, TPIPT Chief, and phone numbers is contained in the Appendix. The ultimate goal is to have one TIRR that integrates the information from all the AFMC Product Centers.

AFMC Product Center TPIPTs	
Aeronautical Systems Center	Space & Missile Systems Center
<ul style="list-style-type: none"> • Counter Air • Air-to-Surface • Mobility • Aircrew Training • Combat Search and Rescue • Special Operations • Electronic Combat • Base Operability & Defense 	<ul style="list-style-type: none"> • Force Enhancement • Space Support • Missile Defense • Strategic Deterrence • Counter Space
Human Systems Center	Electronic Systems Center
<ul style="list-style-type: none"> • Human Systems Integration • Environmental, Safety, & Occupational Health • Operational Medical Support 	<ul style="list-style-type: none"> • Theater Battle Management • Recce/Surveillance/Intell • Strategic Air Defense • Modeling and Simulation • Weather

Figure 2-4 - AFMC Product Center TPIPTs

2.2.7.1 Development Plan

The Development Plan documents the activities that took place during the process cycle and provides an audit trail for the analyses, prioritizations and conclusions made. The Development Plan lists the tasks from the Mission Area Assessment and the deficiencies identified from the Mission Needs Analysis, along with a detailed description of each deficiency (Note: these two sections are taken from the user-generated Mission Area Plan; they are provided in the Development Plan to ensure direct linkage of concepts and technologies to national strategies). The concept options to solve the deficiencies are identified. Each concept is described along with the technologies necessary to enable the concept. The analysis results are also contained in the plan. For each concept, both a concise matrix format and a more detailed background information package documents the analysis behind the conclusions and recommendations made for each concept solution. Thus, at the executive level, a large amount of information is presented in a single, condensed format allowing for comparisons of solutions. The engineering and analysis level data providing details is available in the background information package.

2.2.7.2 Technology Investment Recommendation Report (TIRR)

Although the concept options resulting from the Development Planning process identify the technologies needed for successful implementation of the concept options, these technology needs are limited to the views of the particular TPIPT that produced the concept. To get an integrated view of technical requirements, the technology needs of each TPIPT located at an AFMC product center are combined into one document. This document, the Technology Investment Recommendation Report, provides resource allocation recommendations to the laboratories for the types of technology programs the laboratories should emphasize to support the prioritized needs of the operational command. By blending the inputs from each of the Development Plans produced by that product center's TPIPTs, the Technology Investment Recommendation Report shows the overall importance of a technology program to the success of a mission area. The laboratories, in response, produce technology roadmaps known as Technology Area Plans.

Together, these documents are powerful tools for decision makers and budget advocates. The Development Plan provides analytically based alternatives for solving deficiencies identified by the MAJCOMs, the Technology Investment Recommendation Report provides recommendations to the laboratories for the types of technology programs that will support the alternatives, and the Technology

Area Plan summarizes the technology programs the laboratories are conducting in response to the deficiencies and recommendations. These documents provide justification for a decision maker to choose a particular concept(s).

2.2.8 PAT Derived Process

After thorough review of the complex processes involved in the planning for new and modified systems, the PAT identified those planning/analysis elements within the Air Force that should interface with TPIPTs. The team identified all interfaces for each element and then examined where in this analysis process industry could best participate and how that participation could be accomplished.

The PAT review focused on the analysis functions of the existing development planning process because that functional area seemed to be the area where industry's participation would offer the greatest benefit to both the government and to industry. Details of the overall process derived by the PAT are shown in the Appendix. The process flow diagram is drawn to show input and output to the elements and separately identifies those elements that must be accomplished by the government alone, by industry alone, and those that could be accomplished jointly by government and industry. Figure 2-5 illustrates a summary of how the detailed process was documented and identifies the general elements of the process.

There are nine functional elements identified in the process where joint government/industry participation would be beneficial. Figure 2-6 lists these functional elements. A description of the actions that occur in each of these functional elements is contained in the Appendix.

Another important topic addressed by the PAT was how industry's involvement would be initiated. Figure 2-7 illustrates the approach derived by the PAT. The government would publish a study plan and provide an announcement (probably in the Commerce Business Daily) which would define study requirements and criteria for industry participation. Industry would respond with proposed levels of involvement and define the proposed government/industry relationships for the tasks to be accomplished. The government would review the proposed roles and tasks for approval and acceptance. Once approved by the government, the industry participant is committed to fulfilling its obligation to the analysis tasks.

All of the functional elements of the analysis process associated with modernizing USAF systems existed before this PAT began examining this area. The elements existed generally as important, but independent functions. One key accomplishment of this PAT was to identify how these individual processes must be integrated to provide for the Air Force, an effective Modernization Planning Process.

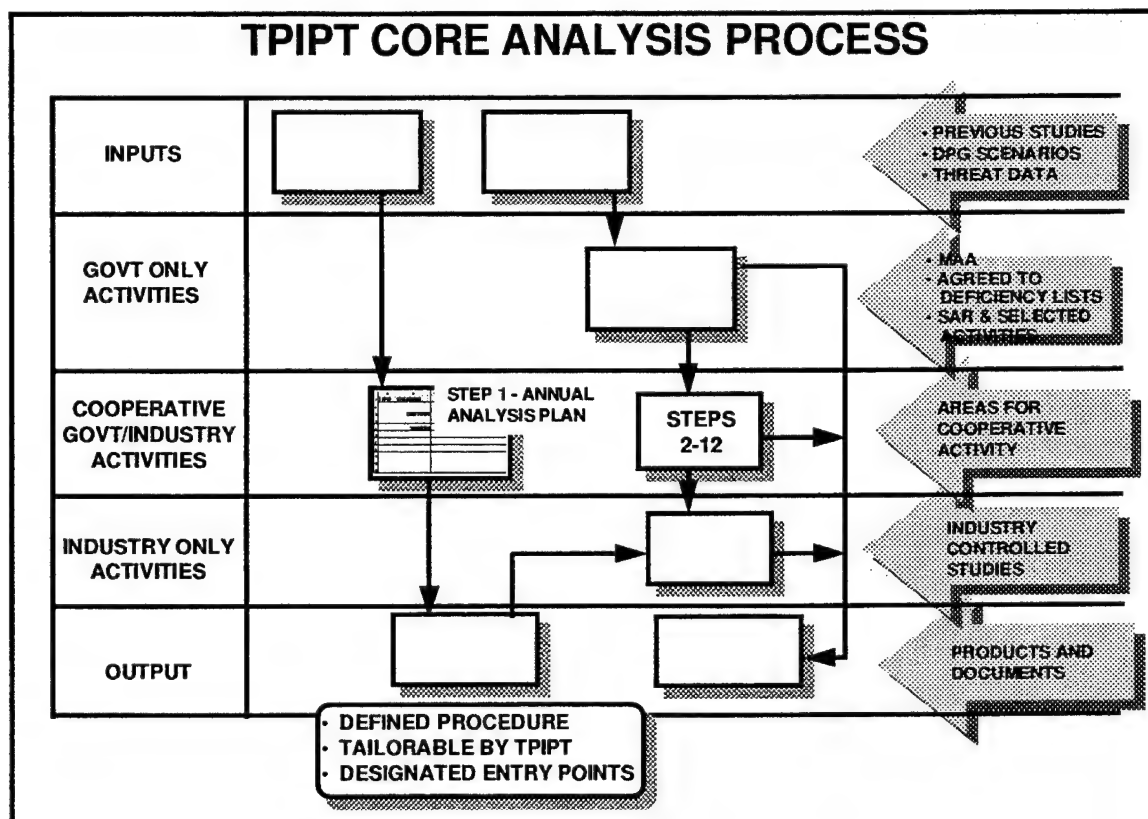


Figure 2-5 - Analysis Process Documentation

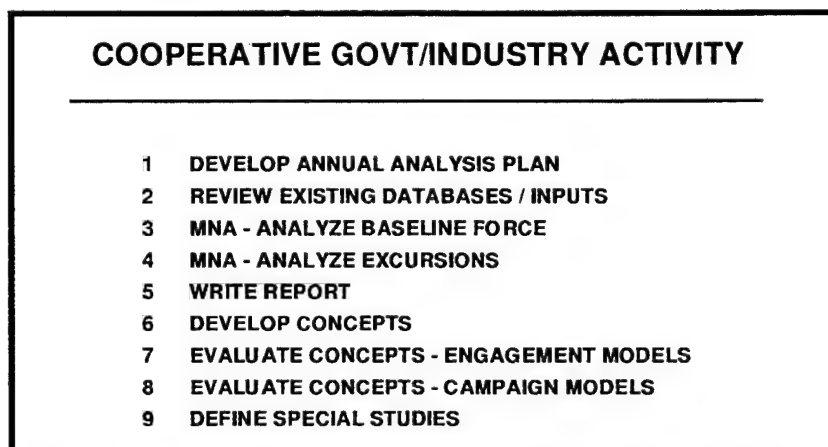


Figure 2-6 - Cooperative Government/Industry Activity

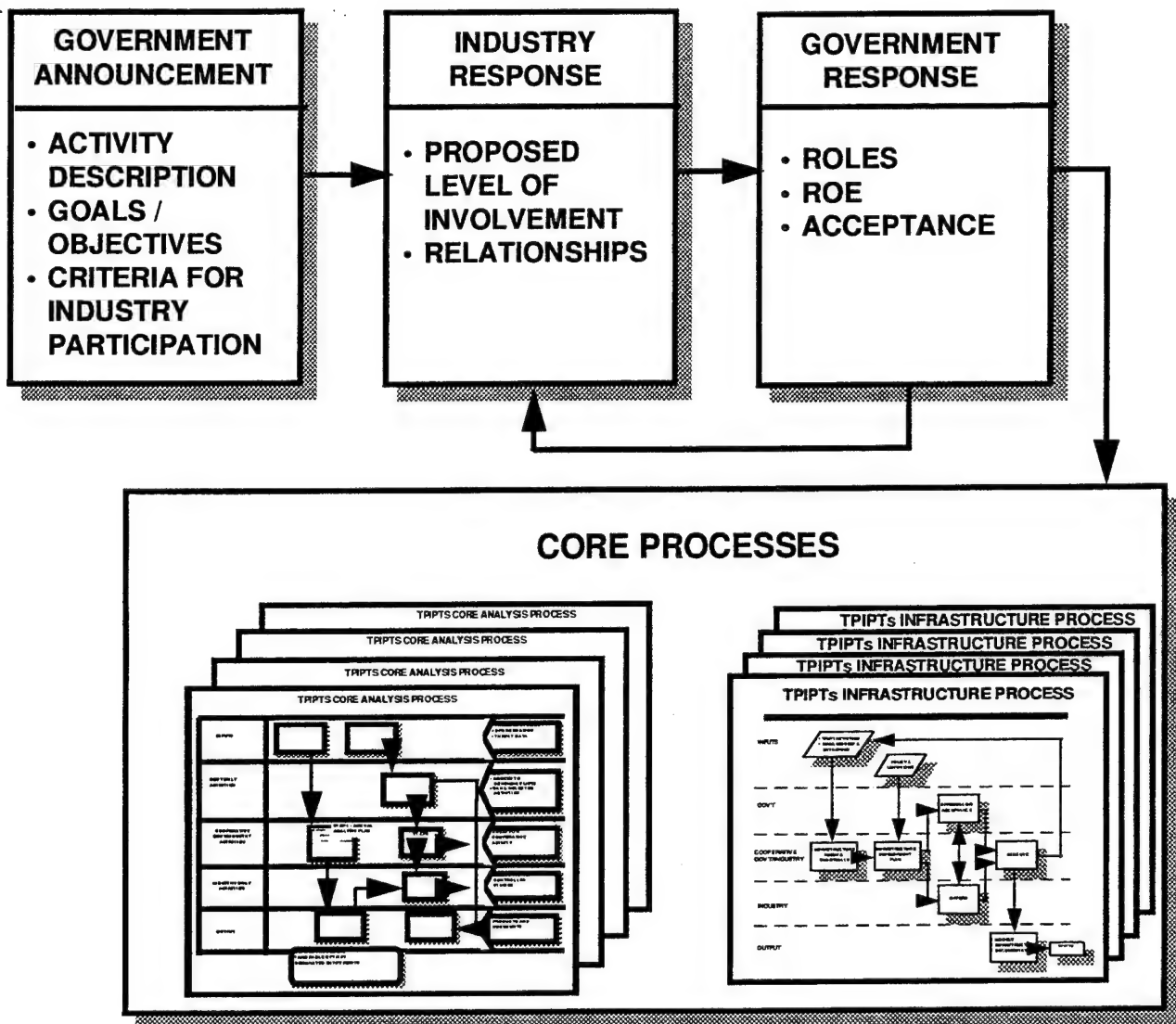


Figure 2-7 - Enabling Approach

2.2.9 Process Summary

The Air Force Modernization Planning Process has many facets and impacts most everything the Air Force does. It helps to focus scarce resources on the important tasks that must be accomplished in order to perform assigned missions in a changing world.

The Mission Area Planning process serves to focus development efforts on satisfying validated/approved using command needs. This is accomplished through a rigorous process that starts with national strategies and develops military tasks needed to support the strategies; continues with a determination of what is needed to accomplish the tasks and identification of deficiencies; develops a broad spectrum of concept options that could satisfy the deficiencies; identifies the technologies

required to enable the concepts; identifies promising analytically-based concept options that satisfy the needs of the using command for its decision making process, and provides technology investment recommendations to the Science and Technology community. This process is led by the users and involves the TPIPTs as a vital part of the multi-constituent body. Throughout the process, the Mission Area Assessments and Mission Needs Analyses led by the Users, and the Development Plans created and published by the TPIPTs feed directly into the annual Mission Area Plan.

The TPIPT process supports the MAP. The TPIPT product is a Development Plan for a mission area or a mission support area. It is based on the results of a tightly integrated, continuous process involving operational command planners, development planners, laboratory scientists, acquisition specialists, and intelligence specialists working together to determine multiple concept options that could solve the user-identified deficiencies. Concepts are developed by the team and provided to the analysts to evaluate each for technical and developmental risk as well as payoff to the user. These evaluations provide the operational users with the information needed to prioritize needs/concepts and make funding decisions. Of particular significance is the fact that this approach allows the investigation of concept options across a wide spectrum of potential solutions instead of tying the investigation to a single weapon system or subsystem solution as was often the case in the past.

The Mission Area Planning concept and the TPIPT process represent a paradigm shift in the planning, programming, budgeting system (PPBS). The transition to the Air Force Modernization Process has just begun. Teams have been formed and the involved organizations are supporting the process. Nevertheless, as with the implementation of all new processes, there are growing pains and there is a learning curve, and the process and products are not yet fully mature. The work of the TPIPTs is a continuous process, and the Development Plans are a snapshot in time--as the product is delivered for support of the upcoming MAP and PPBS cycle, the process continues anew with an update of the Mission Area Assessment and the Mission Needs Analysis to determine inputs for the next Development Plan to support the following year's MAP and PPBS cycle. As a living document, the Development Plan will always have some uncertainties that will be refined in the next version. Each of the 21 TPIPTs have its tailored version of the Development Planning Process and produce a Development Plan document.

2.3 INFRASTRUCTURE

To make this planning process successful or even possible, the TPIPT Core Analysis Process requires an infrastructure to ensure that the process has a current and valid analytical and quantitative basis. The infrastructure comprises three primary elements: 1) methodology (models, tools & simulations); 2) database; and 3) computer hardware/networks for implementing the methodology and data base. The Government/Industry PAT identified a process that maintains and improves the infrastructure, ensuring that methodology and data are available to support the TPIPT analyses.

There are four important aspects of the infrastructure process. First is the requirement that the methodology and data base be accepted by the community as valid standards and are available for use by any participating government and industry organizations. Second, the methodology should be periodically updated, tailoring the methodology to emphasize and focus on the pertinent technical and operational issues of the day. Third, a hierarchy of methodology and data should be available to support the full spectrum of analyses (mission area analysis, mission need analysis, and the concept effectiveness evaluation at the engagement, mission and campaign level). Lastly, two types of methodology are needed. A simplified, quick response methodology is needed to investigate a large number of options in a very short period of time. This requires quick-running models, approved for this type of analysis and used to complement the more detailed models. This methodology will be used to obtain the "80% solutions." A second, more detailed methodology is needed to take a more detailed look at technical and operational issues that cannot be resolved with top-level analysis.

The TPIPT Infrastructure Process identified by the Government/Industry PAT is depicted in Figure 2-8. The format of Figure 2-8 is similar to that shown for the TPIPT Core Analysis Process (see Appendix). The figure is divided into five horizontal groupings. Along the top of the figure are the inputs used by the TPIPT Infrastructure Process. Along the bottom of the figure are listed the outputs generated by the process. The three middle groupings indicate which elements of the process are to be performed by only the government, performed as cooperative government/industry activities, and performed by industry only.

TPIPTs INFRASTRUCTURE PROCESS

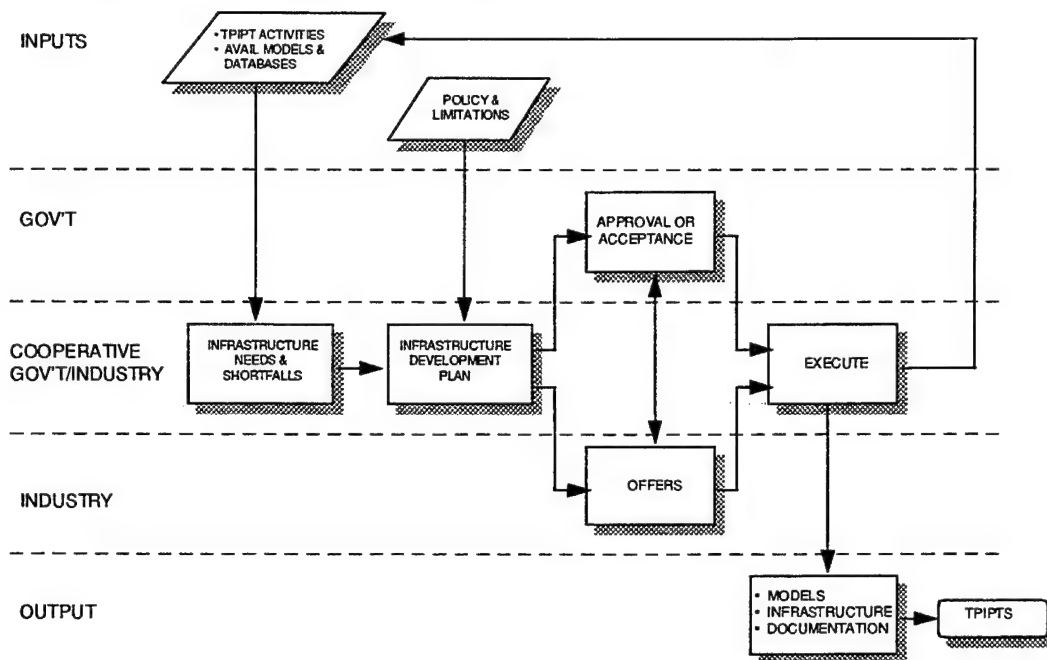


Figure 2-8 - TPIPTs Infrastructure Process

As indicated at the top-left portion of Figure 2-8, the process used to maintain and improve the TPIPT infrastructure is initiated by the planned TPIPT activities. Each year the TPIPTs will develop and document an Air Force analysis plan, indicating the specific analyses that will be conducted. The plans will include the options to be studied, the critical technical issues requiring resolution, and a description of the analysis methodology needed to gain the required answers. As the first step in the TPIPT Infrastructure Process, an assessment will be made of the current ability of the baseline infrastructure (i.e., models/simulations, computer hardware/network, and databases) to carry out (support) the TPIPT analysis plan. Shortfalls in the ability of the baseline infrastructure to support the TPIPT analysis plan will be identified.

As the next step in the TPIPT Infrastructure Process, an infrastructure development plan will be formulated. It will identify a roadmap (tasks and schedule) for modifying the current infrastructure to alleviate the shortfalls identified in the previous step. The infrastructure development plan will be developed to be consistent with DoD policies and budget limitations. The infrastructure development plan will be submitted to the government for approval and acceptance. Simultaneously, the plan will be shared with industry for comment and coordination. Industry will be given the opportunity to specify

which portion(s) of the infrastructure development plan they would like to perform. The government will review the offers of support made by industry and make a final decision on which industry organizations will be responsible for the various elements of the infrastructure development. Once approved by the government, the industry participant is committed to fulfilling its obligation to the development tasks and schedule.

As a last step in the TPIPT Infrastructure Process, the infrastructure development plan will be implemented. Once the development is completed, the upgraded infrastructure (models/simulations, databases, and computer hardware/network), along with documentation upgrades, are the output of the process. The upgraded infrastructure is ready for use by the TPIPTs to conduct the planned analyses. As shown by the feedback loop in the figure, the upgraded infrastructure also becomes the new baseline methodology for assessing the infrastructure shortfalls in meeting next year's planned TPIPT analyses.

2.3.1 Description Of Needed Models, Databases And Tools

In order for the Infrastructure Process outlined in the previous section to operate effectively, there are some improved models, databases and analysis tools needed. These include official government scenarios, an understanding of the military objectives, a description of the threat information that might be needed to do the analysis, any concept of operations or tactics that may be relevant, as well as joint service information. All of these would have to be provided in a timely and usable manner. Additionally, all the current models and databases would need to be evaluated for their applicability.

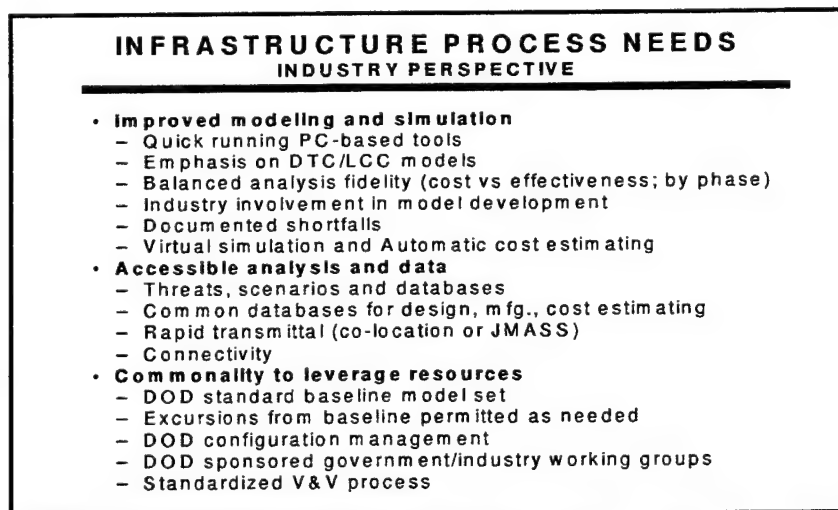


Figure 2-9 - Infrastructure Process Needs

Perhaps more important than the actual inputs required; however, are the characteristics of the needed databases and tools. A side session of the PAT team composed of industry members developed a list of what they believed was needed, which is summarized in Figure 2-9. Although these items reflect industry's viewpoint, they would be desirable from the government point of view also. The characteristics of the needs generally fall into three categories: improvement, accessibility, and commonality, and are discussed below:

2.3.2 Improved Modeling and Simulation

One of the more important characteristics for models and simulations is that they be quick-running. Almost as important is that they be easy to use. Historically, as analysts attempt to develop more sophistication and realism in the simulation analyses conducted, the models became larger, more complex, more difficult to use; they require a large quantity of data and can only be run on workstation size computers. These models are generally slow to operate because of all the complex interactions to be simulated. A few of these models have been converted to operate on a personal computer, but their operation remains very slow, usually because of the model's large size. Within the Air Force analysis organizations, six of these large models have evolved to become the "standard" analysis models for combat analysis of military aircraft systems.

The "standard" models are THUNDER for campaign analysis, SUPPRESSOR and EADSIM for mission level analysis, and BRAWLER, ESAMS, RADGUNS for one-on-one engagement analysis. Analyses conducted with one of these models are generally considered "credible" (assuming valid input data). Use of these large, complex models is acceptable when a limited number of cases are involved or when time available for the analyses is not a factor. The problem facing most TPIPTs; however, is a large number of cases to evaluate (concept options) and a short time to accomplish the analyses. The TPIPT analyst is thus presented with a difficult situation; the concept analyses require use of the "standard" models for credibility, but there is not sufficient time using the large models to analyze more than a few concepts or parameter sensitivities.

This "problem" highlights the need for simple, easy to use models that can operate quickly on a personal computer. These models would complement the large, detailed "standard" models and would enable the analyst to screen a large number of cases (concepts) quickly to determine which ones are ineffective or which ones need to be analyzed in more detail using one of the detailed "standard"

models. The PC-based models can also be used to conduct parametric analysis quickly on the characteristics of the concepts to help formulate and refine concept requirements.

Thus, easy to use, quick-running, PC-based combat models are essential to the TPIPT analysis process. Additional effort will be necessary by the modeling and simulation “community” (and perhaps the Modeling and Simulation TPIPT) to develop “valid” PC-based models or to validate existing PC-based models so that results from these models compare favorably with the detailed “standard” models. It has often been stated that PC-based models can provide an 80% solution to the problem. This does not imply the model is 20% incorrect; rather, the PC-based model provides a solution that, while not simulating all complex interactions of a system or force engagement, does model sufficient interactions to determine the correct *trend* or *domain* of the solution. This type of result is very useful for TPIPT analyses, especially when all solution options are evaluated *relative* to each other and relative to a baseline system, using the same PC-based model. For example, the PC-based models could be used to determine that Concept A has a 20% better probability of survival when compared to the baseline existing system and Concept B has a 30% better survival rate, etc. But if decision-makers needed to know with great certainty that the probability of survival for Concept A was greater than 0.90, then one of the detailed models should be used.

Because of the current emphasis on cost in the selection of promising concepts, and particularly cost effectiveness, it is important that our cost models reflect that emphasis. A lot of effort has been expended in developing refined and sophisticated effectiveness models; now there has to be an equivalent effort on Design to Cost and Life Cycle Cost tools. The goal is to have an equivalent fidelity in both the cost and effectiveness models and as with the effectiveness models, have some “validated” PC-based cost models.

2.3.3 Accessible Analysis and Data

As mentioned earlier, key inputs to the models used for the analytical process are threats, scenarios and databases. These have to be in sufficient detail to provide the necessary information for input into the models. They also have to be provided in a timely manner since they initiate the whole analytic process. One problem associated with accessibility is getting the data quickly and in a usable manner. Collocation of analysts was one solution discussed by the PAT. This solution would assure rapid transmittal of data. Alternately, having a common software architecture such as JMASS may be

another solution. In any case, relying more on electronic media for transmittal, while using common formats should help.

2.3.4 Commonality to Leverage Resources

Having a standard baseline model set would be the biggest factor in providing commonality between industry and government, and within industry. This would allow significant savings if only a single set of scenario inputs needed to be created, for example; especially for the very detailed well established models that require hundreds of inputs. Excursions from these baseline models could be created to examine unique features as required. What is selected for this standard set of models is not a simple task and will take some time to determine. Configuration management would have to be maintained within the government, as well as verification and validation of those models. This would be a highly desirable area to have government/industry working groups.

3. LESSONS LEARNED

Two types of lessons were learned during PAT-1. The first type deals with the analytical aspects of weapon system modernization planning and the second type involves generic lessons common to most team activities, i.e., group dynamics. Both types of lessons learned have already been taken into account in PAT-2 formation and execution.

- (1) Quantitative, long range, modernization planning is complex and no common end-to-end method existed when PAT-1 was formed. Similar, related approaches were being used by MAJCOMs, developers and technologists; however, they were not well integrated. This obstacle complicated the realization of PAT-1's primary goal -- industry involvement. The lesson learned was to develop a baseline framework and then evolve it.
- (2) Modernization planning encompasses user requirements, development planning, technical planning, technology planning and funding considerations. This integration and funding were beyond the scope of PAT-1, but must be addressed as first priority in another activity.
- (3) Modernization planning requires unique, highly sophisticated analytical skills, knowledge and experience; specialized databases; fast running models for requirements, concept effectiveness, cost estimation and cost effectiveness analysis; as well as decision aids for selecting alternatives. These tools do not replace larger legacy models, but rather, they are required to select alternatives from a large case matrix prior to doing more in-depth analyses on the preferred concepts or technologies.
- (4) The amount of time required for a Process Action Team with diverse backgrounds to operate as an integrated team depends on the size of the group, level of pertinent knowledge, amount of prior preparation, etc. Particular attention has to be paid to matching the team's charter to its membership, i.e., analysis process development requires senior analysts working in small groups of five people or less.
- (5) Instructional and tutorial materials are essential for providing a "jump" start. Examples are definition of the terms and the processes. Expectations of participants, and of all inputs and outputs for the processes to be evaluated should also be identified. It took considerable time for PAT-1 to develop a common vocabulary and a clear description of the TPIPT process.

4. SUGGESTIONS FOR FOLLOW-ON ACTIVITIES

This process action team (PAT-1) primarily addressed the analysis phase of the TPIPT process and identified all the processes, their interfaces with other analysis efforts and how all elements of these processes must integrate together to support the acquisition of new and modified military systems. During the time this PAT conducted its activities, the importance of analysis in the determination, refinement and justification of new systems, was becoming established throughout Air Force planning activities. Also during this time, an Air Force Modernization Planning Process began to evolve in which the operational needs, concept solutions, effectiveness evaluations, and enabling technologies are integrated to help develop and support the Air Force POM.

Recognizing the importance of TPIPT analysis in this evolving modernization planning process, Lt. Gen. Fain, then Commander of Aeronautical Systems Center, during ASC's 25 August 1994 Quality Symposium, chartered a new Process Action Team (PAT-2) to ensure the effective integration of PAT-1 results into the new planning process and to ensure the new planning process is adequately defined, chartered, advocated and funded with participation by industry. It is important that the PAT-2 members are fully briefed on the PAT-1 results. PAT-1 also recommended that a Technical Planning Society should be formed to enhance the professional image of development and technical planning and to provide a forum for the exchange of ideas, data, analysis, results and models. Mr. Lavon Jordan, President of Frontier Technology, Inc. has taken the initiative to start this technical society and several initial planning meetings have been conducted. A final activity is to continue actions to "sell" the vision of the Air Force Modernization Process during and after PAT-2 completes its work.

APPENDIX

APPENDIX

- A AFMC TPIPTs and TPIPT Chiefs**
- B TPIPT Analysis Process Flowcharts**
- C PAT Members**
- D Definitions, Abbreviations, and Acronyms**

APPENDIX A

AFMC TPIPTs and TPIPT Chiefs

TPIPT	Function	TPIPT Chief
Air Base Systems (ABS)	Addresses the base operability and base defense missions.	Lt Col Larry Clausen
Aircrew Training	Addresses the aircrew training mission support area including planning for training aircraft and aircraft simulators.	Lt Col Timothy Choate
Air-to-Surface	Addresses the strategic attack, interdiction, and close air support missions.	Maj Greg Sparks
Combat Search and Rescue	Addresses the combat search and rescue mission area.	Lt Col Bob McCarty
CounterAir	Addresses offensive counterair, defensive counterair, suppression of enemy air defense, and theater missile defense tasks. In addition, the TPIPT addresses the combat air-to-air identification mission support task	Ms. Deborah Westphal
Electronic Combat	Addresses the electronic combat mission.	Mr. William Zorovich
Mobility	Addresses the airlift and air refueling missions. C4I systems used for the mobility missions are also covered by this TPIPT.	Lt Col Thomas Humes
Special Operations	Addresses the special operations missions.	Maj Jeff Illig
Information Warfare	Address the information warfare mission.	Lt Col Ken Marvin
Modeling and Simulation	Address all aspects of the mission support are associated with models and simulations. This area plans for modeling and simulation tools that support the analysis and planning for all other missions and mission support areas.	Col John O'Pary
Reconnaissance/Surveillance /Intelligence	Addresses the reconnaissance, surveillance, and intelligence missions.	Maj Dave Honey
Strategic Air Defense	Addresses the ACC strategic air defense mission associated with North American air defense. It includes warning systems, C4I, and air interceptors.	Mr. Augie Stratoti
Theater Battle Management	Address the battle management mission.	Lt Col Dick Burgess
Weather	Addresses the weather mission support area to include environmental sensing and forecasting systems.	Capt Steve Hallin
Environment, Safety, and Occupational Health	Addresses all mission support areas associated with the environment, safety, and occupational health.	Lt Col Rick Drawbaugh
Humans Systems Integration	Address human-related mission support areas to include human resources, aerospace medicine, and crew systems.	Col Larry Carr
Operational Medical Support	Addresses the medical support area. Addresses all medical requirements not covered in aerospace medicine -- to include surgeon general training, sustainability, and support needs.	Col Bob Miller

Force Enhancement	Addresses several mission areas that fit into the force enhancement aerospace role. These mission areas are communications, navigation, environmental sensing, and reconnaissance and surveillance.	Maj Reggie Holmes
Space Control	Addresses space surveillance, counter space, missile warning, and space based ballistic missile defense command, control and communications (BMDC3) tasks.	Maj Dan Durham
Space Forces Support	Addresses the space lift (launch), satellite control, and command and control (C2) missions.	Capt Mark Olson
Strategic Deterrence	Addresses the nuclear deterrence and conventional deterrence missions. It covers ICBM sustainment and technology as well as nuclear bombers with the support of ASC/XRS.	Mr. John Mitchell

APPENDIX B

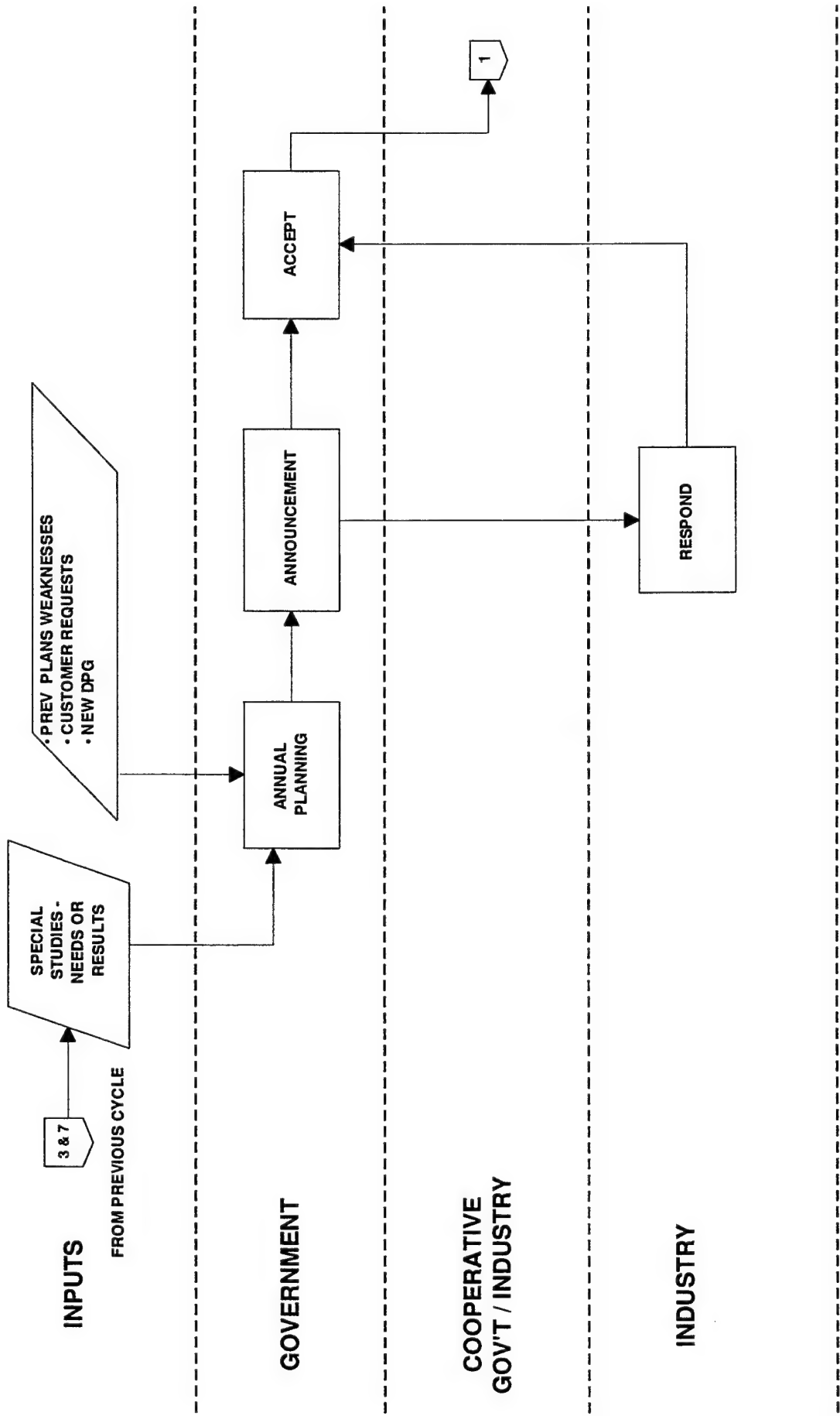
TPIPT Analysis Process Flowcharts

DESCRIPTION OF TPIPT ANALYSIS PROCESS

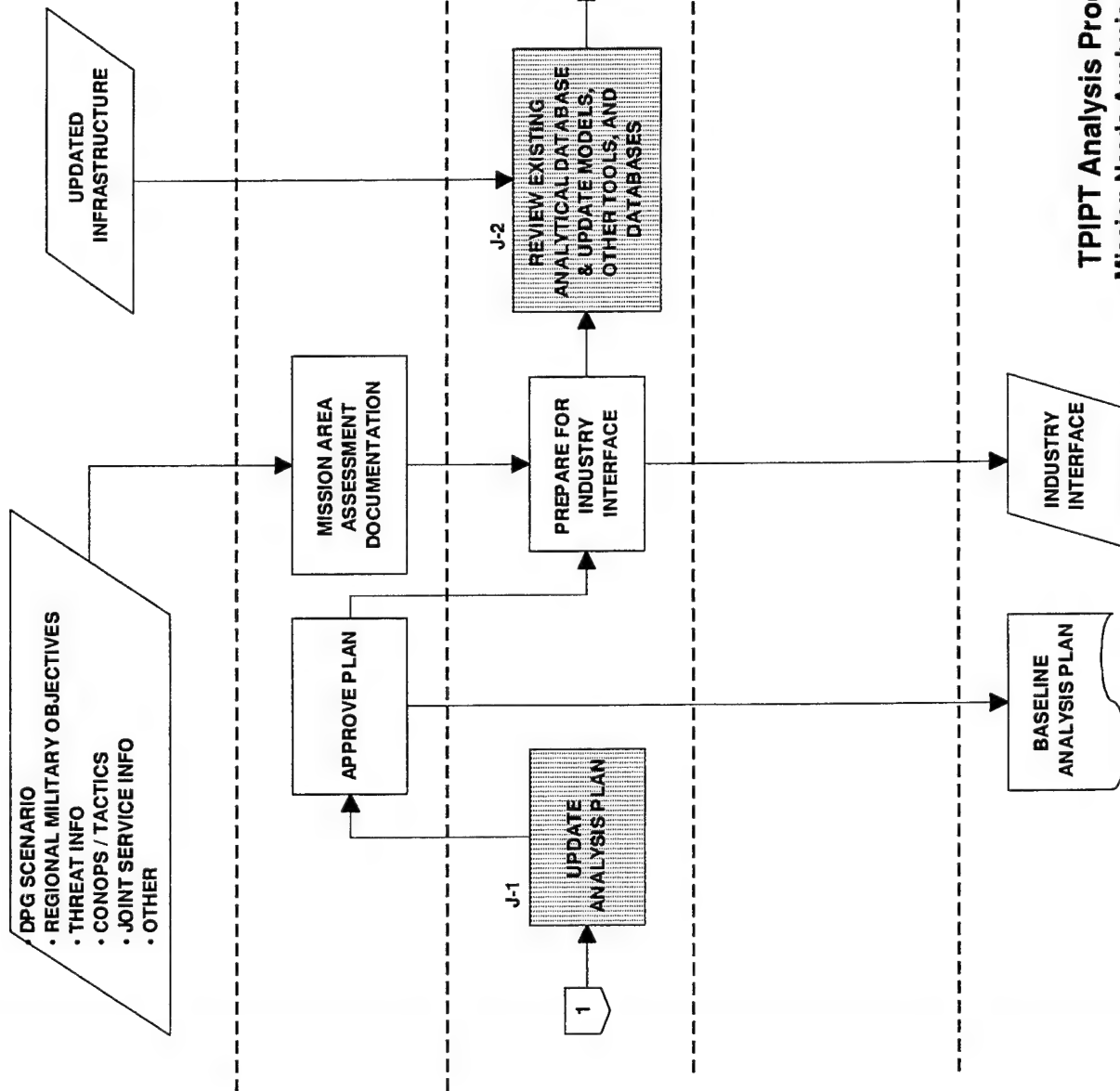
The primary objectives of this PAT were to help mature the TPIPT process and to determine ways for industry participation. The team spent the majority of its productive effort on these aspects of technical planning. Figure 2-1 contains an overview and perspective of the process, but it does not illustrate participant roles. This section of the appendix presents six pages of detailed analytical flowcharts for one TPIPT cycle, the rationale for the content on each page and a table describing nine joint government/industry activities.

B-1 DETAILED FLOWCHARTS

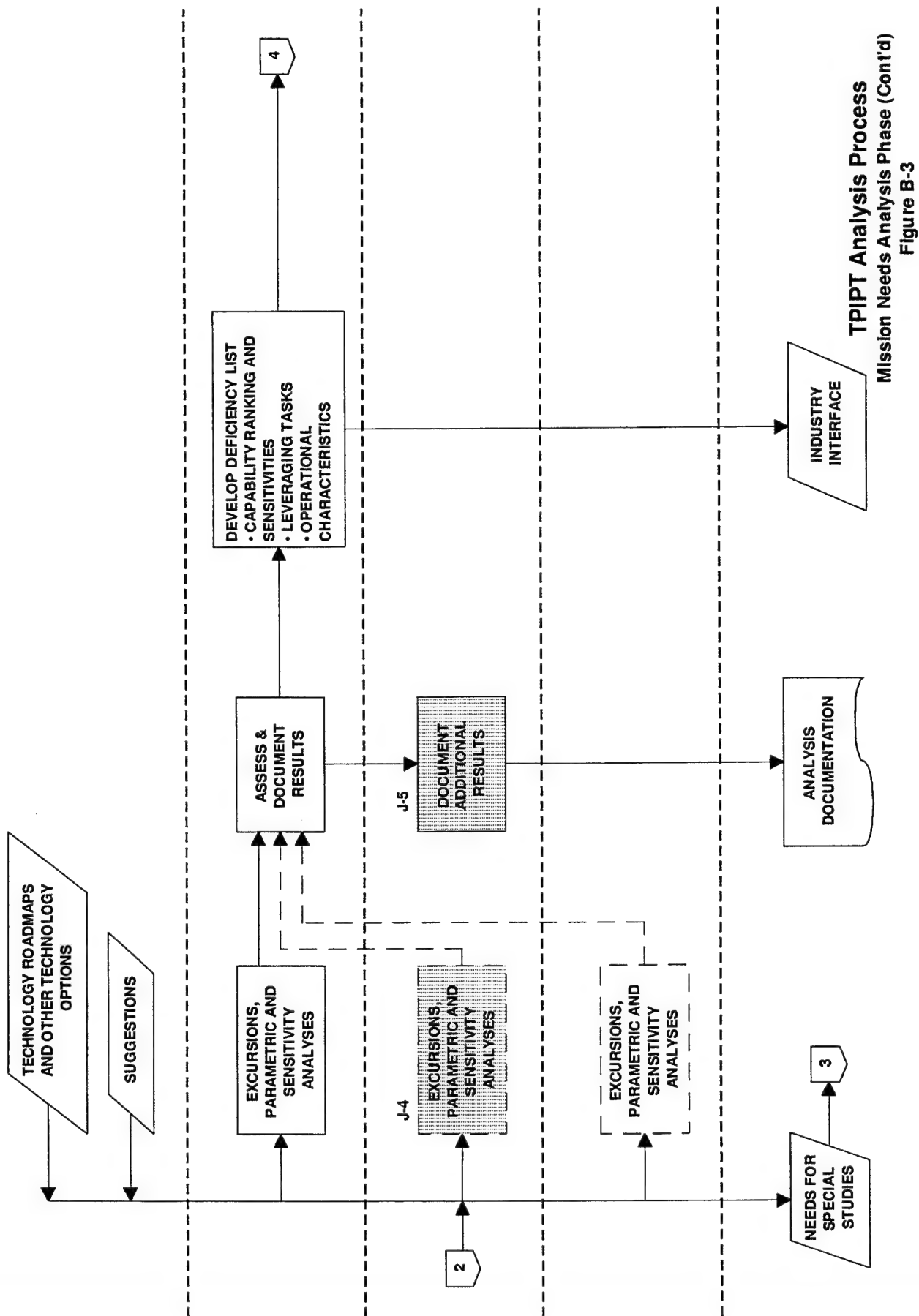
The TPIPT analysis process can be divided into four distinct phases. The first chart (Figure B-1) contains the Planning Phase. To treat the quantitative Mission Needs Analysis Phase adequately required two charts (Figure B-2 and B-3). The third phase, Formulate and Evaluate Concepts also requires two charts (Figure B-4 and B-5). Figure B-6 identifies the steps in the Development Plans and TIRR Preparation Phase. In addition to illustrating the analysis flows, each flowchart contains the inputs, government-only activities, joint activities, industry-only (potential proprietary) activities, and major outputs. The solid boxes denote primary responsibility and the dashed ones indicate secondary responsibilities. The Government is in complete control of the process from start to finish.

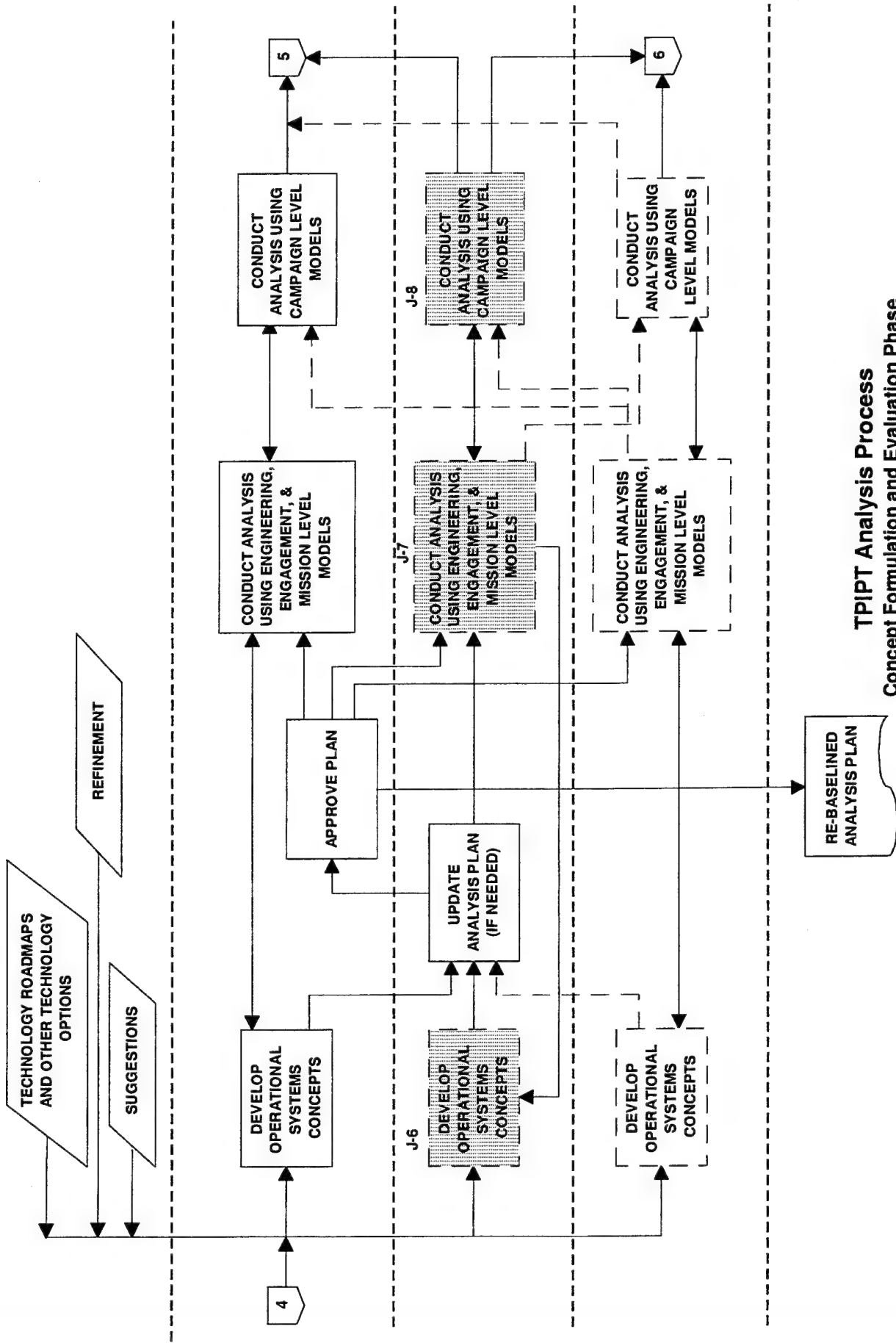


TPIPT Analysis Process
Planning Phase
Figure B-1

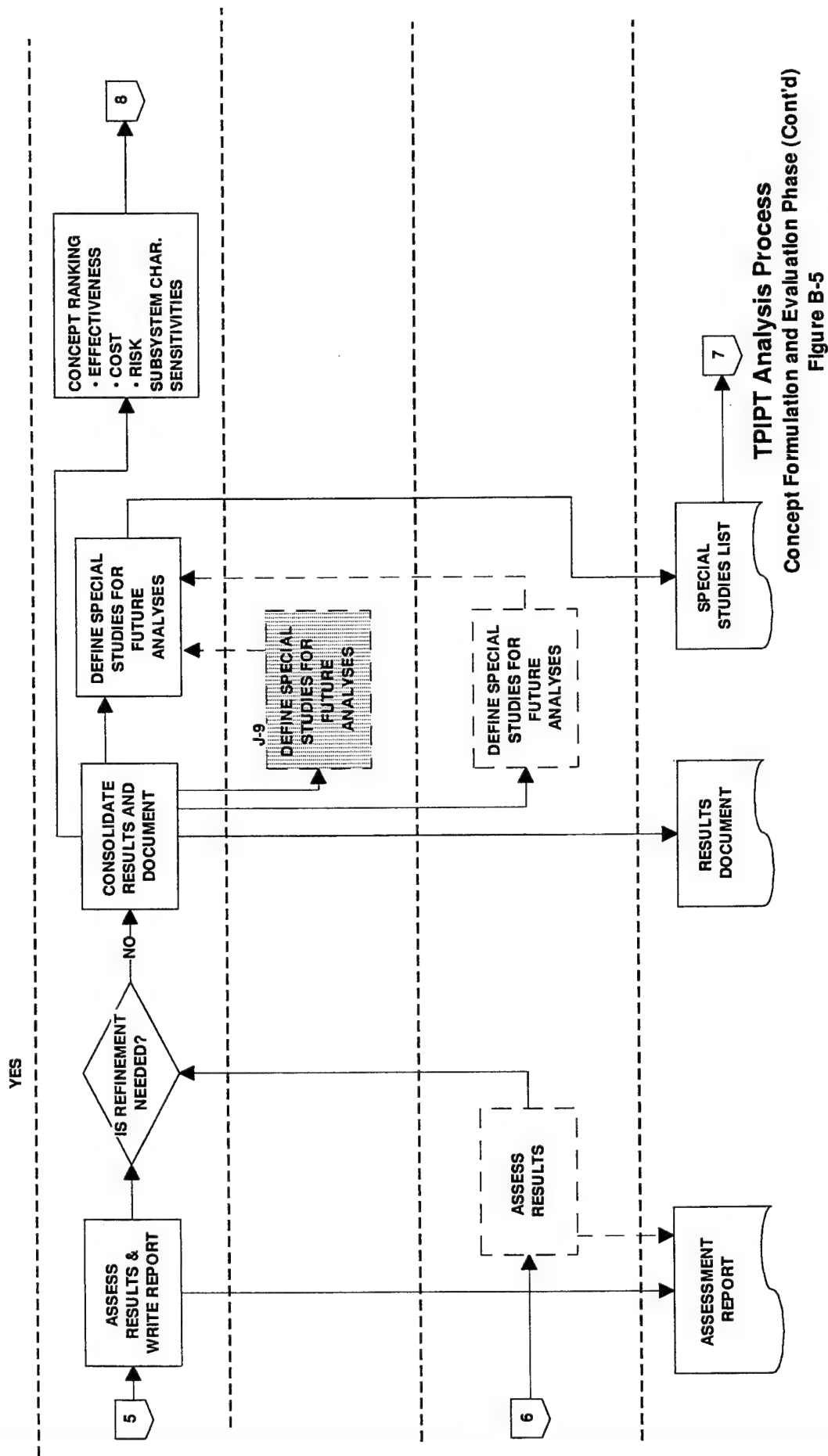


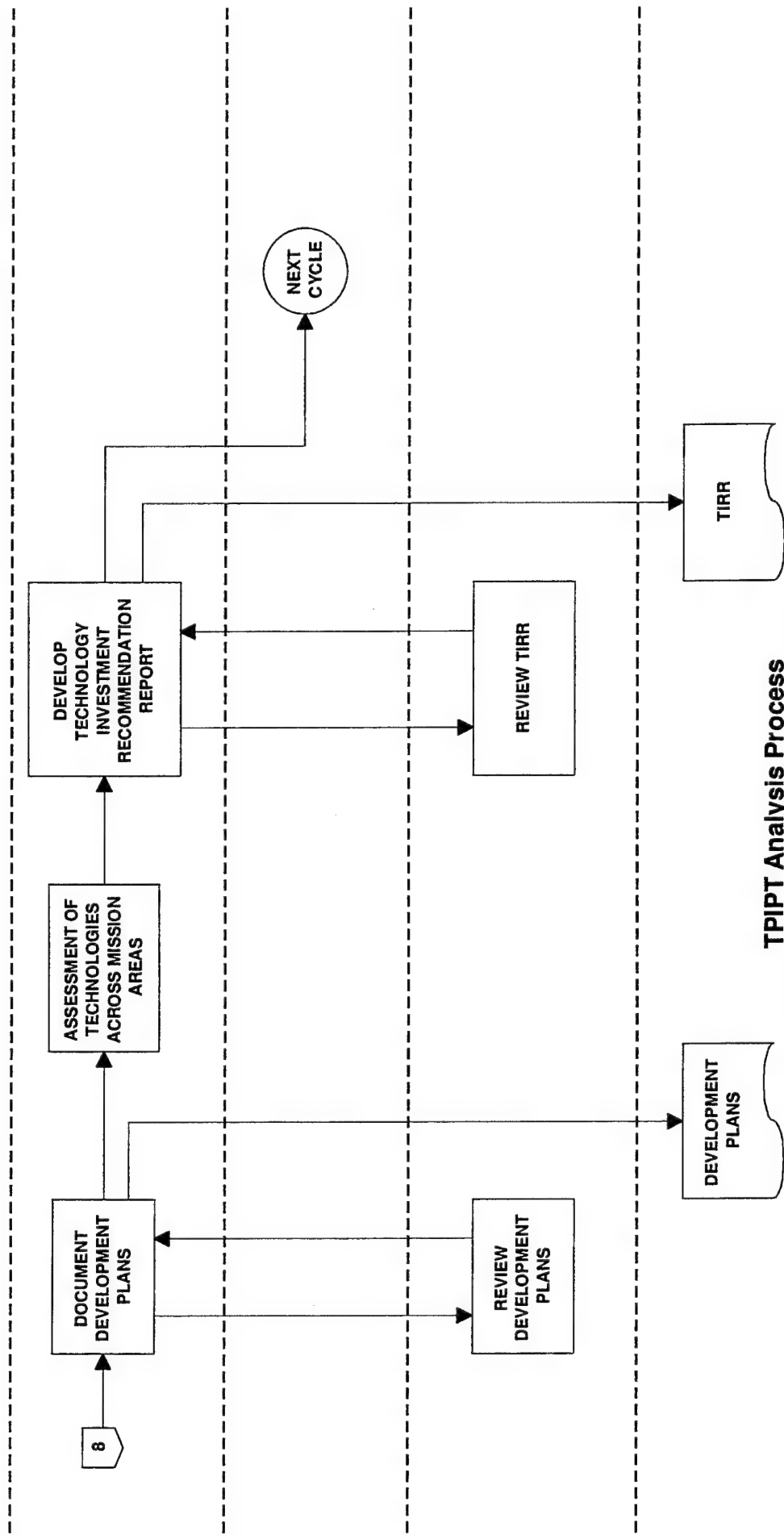
TPIPT Analysis Process
Mission Needs Analysis Phase
Figure B-2





TPIPT Analysis Process
 Concept Formulation and Evaluation Phase
 Figure B-4





TPIPT Analysis Process
Development Plan and TIRR Preparation Phase
Figure B-6

B-2 DESCRIPTION OF JOINT GOVERNMENT/INDUSTRY ACTIVITIES

Nine joint planning, reviewing, modeling, analysis, conceptual development, special studies and documentation activities were selected and recommended by the PAT. These activities, contained in Table B-1, were the results of careful scrutiny as contained in the next section of this appendix. Some activities are new, e.g., publication of an Analysis Plan at the beginning of each TPIPT cycle. Some activities are not new, e.g., reviewing databases, developing concepts, running models, doing special studies, reviewing government plans; however, performing these activities as an integrated team is definitely new. The team believes that both parties will benefit from these joint activities and that they can be done without violating applicable regulations, policies and laws. In addition, these joint activities will not replace the need for analytical contractors in their traditional role of direct support to Government-only or joint activities.

Table B-1
Joint Analysis Activities

	TITLE	DESCRIPTION
J-1	Develop Analysis Plan	<ul style="list-style-type: none"> • Funding availability/distribution • Schedule • Membership/participation • Business relationship/written understanding • Scope of analysis activity • Proprietary accommodation • Distribution of products • Analysis metrics
J-2	Review Existing databases/models	<ul style="list-style-type: none"> • Determine groundrules and assumptions relative to analysis • Review models and tool set • Extract relevant information • Document shortfalls
J-3	Analyze Baseline Force (same Aspects)	<ul style="list-style-type: none"> • Interaction with government led MNA • Criteria establishment • Metrics determination • Compute metrics (MOOs, MOEs)
J-4	Analyze Excursions	<ul style="list-style-type: none"> • Postulate Variations/Excursions • Recalculate MOOs and MOEs • Display MOOs and MOEs as a function of excursions
J-5	Write Report (Results of Excursions, Parametric & Sensitivity Analyses)	<ul style="list-style-type: none"> • Draft, edit, publish, distribute • Prepare for industry interface • Update databases
J-6	Develop Operational System Concepts	<ul style="list-style-type: none"> • Select several concepts for top of TPIPT's matrix <ul style="list-style-type: none"> • Existing inventory • P³I • EMD • Advanced concepts • Establish initial characteristics by using engineering tools
J-7	Use Standard Engagement and Mission Level Models	<ul style="list-style-type: none"> • Compute metrics for system concepts • Iterate with J-6 as required
J-8	Use Standard Campaign Models	<ul style="list-style-type: none"> • Run analysis and compute metrics for systems • Iterate with J-6 and J-7 as required
J-9	Identify Special Studies Needed	<ul style="list-style-type: none"> • Define areas, scope and needed products for special study. • Must be started early to influence future Development Plans and TIRRs

B-3 ALTERNATIVES FOR INDUSTRY PARTICIPATION

The PAT examined each potential joint activity by defining it in some detail and then by comparing how, and to what level, industry should be involved. Two examples were selected for publication. The first example (Table B-2) applies to all categories of joint activities and was the team's baseline for comparison. Table B-3 is interesting because it deals with an area of primary industry interest, i.e., concept formulation and subsequent evaluation.

Table B-2
Alternatives For Industry Participation - Baseline

CATEGORY: Baseline Pros and Cons applicable to all categories

ALTERNATIVE	PROs	CONs
1. Government accomplishes task then coordinates with industry for feedback. - Govt could use support contractor - Would iterate with industry as necessary	- Quicker initial draft of task - More government control - Easiest to control security - Minimal cost to industry	- Potential delayed industry buy-in and/or commitment of resources
2. Representative subset of industry (i.e. small group)	- Still manageable - Some immediate industry buy-in	- More admin burden to structure business agreements to be fair - May give those companies directly participating an advantage
3. Open industry participation (i.e. large group)	- Maximizes participation - Fairest to the most companies - Quickest buy-in by industry - Brings the most ideas to the table - If all participating, may not need an Industry Day	- Some admin burden to structure agreements - Time consuming -- will take longer since group is bigger - More total expense since takes longer and more participants traveling - More burden on security people
4. Apportioned activities - Industry agrees to share the work - Industry may also fund the work	- Reduced total cost to industry if they share the work to eliminate duplication	- User buy-in if not govt led - Integration more difficult - Documentation and audit trail - Individual company's "pet rocks" - May be scrap and rework if no day-to-day interaction

Table B-3

Alternative For Industry Participation In Concept Formulation And Evaluation

CATEGORY: Formulate and Evaluate Concepts

ACTIVITY: Develop Operational System Concepts (J-6)

- Identify/define concepts for each category along the top of the TPIPT matrix:
 - Existing inventory
 - System in EMD
 - P³I
 - Advanced concepts
- Define/establish initial characteristics from existing databases or by using engineering toolsets for new concepts
- Need to allow for proprietary and Special Access Required (SAR) annexes if desired to have industry and govt offices bring best ideas forward to be analyzed
 - May need to do these govt only or one-on-one
 - Industry should certainly all participate and share in non-proprietary concept activity

ADDITIONAL PROs OR CONs TO BASELINE

ALTERNATIVE	PROs	CONs
1. Government only (Not an acceptable alternative from PAT perspective-- Industry needs to play)	- Easier to protect industry's proprietary	- May miss lots of good ideas from industry - May not include large enough window of representative candidates to cover what industry could propose
2. Representative subset of industry	- Brings many industry needs to table	- Requires careful government oversight to ensure no favoritism - Potential for proprietary data leakage
3. Open industry participation	- Allows opportunity for all potential concepts to be brought to table	- Increased potential for proprietary data leakage since more participants involved - May be too many concepts to analyze

NOTE: Apportioned activities not an acceptable alternative. Apportionment only make sense for the proprietary concept activities because the government must be fair and cannot afford to have individual "pet rocks" from some companies be included and others not. Must share and do together for anything not proprietary.

APPENDIX C

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KEY: A - Analyst
 C - Contractor
 Co - Co-Chair
 L - Legal
 O - Owner
 T - Technology

APPENDIX D

DEFINITIONS

Strategy-To-Technology: The modernization process that begins with the national strategies and evolves to the technologies that enable or support strategies. The four elements of this process are:

- 1) **Strategy-To-Task:** That portion of the modernization process where the MAA is accomplished and documented. It provides an audit trail from the broadest national objectives and strategies down to operational activities at the tactical engagement level.
- 2) **Task-To-Need:** That portion of the modernization process where the MNA is accomplished and documented.
- 3) **Need-To-Concept:** That portion of the modernization process where concepts are developed which can solve an identified deficiency. These concepts can come from various sources such as the laboratories, the user command, the development community, industry, etc.
- 4) **Concept-To-Technology:** That portion of the modernization planning process where specific technologies necessary for the successful development of a potential solution concept are identified.

Development Plan: The primary product of the TPIPT. This plan documents the assessment analysis and planning processes applied to each mission area and provides a comprehensive, 25-year evolutionary plan for mission capability development and modernization.

MAA: Mission Area Analysis. A process designed to enhance the Air Force warfighting capabilities by identifying military objectives in the Defense Planning Guidance, Joint Strategic Capabilities Plan, Air Force guidance, and regional Operations Orders and Operations Plans. The MAA uses a “strategy-to-task” methodology to identify the operational and support tasks needed to achieve military objectives.

MNA: Mission Needs Analysis. A process designed to assess the Air Force’s ability to accomplish the tasks identified during MAA. The MNA uses a “task-to-need” methodology to analyze the force structure, geo-political environments, projected advances in technology, and expected threats affecting

current and programmed capabilities to accomplish a task. The process identifies deficiencies in current and programmed capabilities.

Mission Deficiency: The inability to accomplish an operational or support task required for the achievement of a military objective.

MAP: Mission Area Plan. The primary product of the operational command's modernization planning process. It covers 25 years, uses the results of the MAA, MNA, and the Development Plan to document the most cost effective corrections of task deficiencies from among non-materiel solutions, changes in force structure, systems modifications, science and technology (S&T) applications, and new acquisitions.

TIRR: Technology Investment Recommendation Report. This is the second major product of the Need-To-Concept, Concept-To-Technology portion of the modernization process. It is a ranked prioritization of the technology needs identified in all 21 Development Plans. This document is then provided to both the laboratories and the S&T community to help them make future technology investment decisions.

TMP: Technology Master Process. AFMC's process for planning and executing a seamless AFMC science and technology strategy. As related to the MAP, the TMP involves the identification of customer deficiencies requiring technology solutions; development of candidate system solutions; generation of technology needs identifying specific levels of performance or capability; definition of S&T projects required to meet the critical enabling technology needed; and organization of S&T resources.

TPIPT: Technical Planning Integrated Process Team. An element of the AFMC TMP responsible for identifying and addressing customer technology needs with an optimized and integrated AFMC response. It provides AFMC's support to the preparation of MAAs, MNAs, and MAPs. In addition to coordinating AFMC's support, they coordinate national laboratories, industry, and academia input to the MAA, MNA, and MAP process. They also support the planning process with modeling, simulation, analysis, concept development, technology need identification, and pricing.

ABBREVIATIONS AND ACRONYMS

ACC	Air Combat Command
AF	Air Force
AFAE	Air Force Acquisition Executive
AFB	Air Force Base
AFMC	Air Force Materiel Command
ALC	Air Logistics Center
ASC	Aeronautical Systems Center
EMD	Engineering and Manufacturing Development
FY	Fiscal Year
IPT	Integrated Product Team
IR&D	Independent Research and Development
MAA	Mission Area Assessment
MAA	Mission Area Analysis
MAJCOM	Major Command
MAP	Mission Area Plan
MNA	Mission Needs Analysis
MNS	Mission Needs Statement
MOA	Memorandum of Agreement
MOU	Memorandum of Understanding
ORD	Operational Requirements Document
OSD	Office of the Secretary of Defense
PAT	Process Action Team
R&D	Research and Development
ROE	Rules of Engagement
S&T	Science and Technology
SPO	System Program Office
TAP	Technology Area Plan
TEO	Technology Executive Officer
TIRR	Technology Investment Recommendation Report
TMP	Technology Master Process
TIPT	Technical Planning Integrated Product Team
USAF	United States Air Force
WL	Wright Laboratory
WPAFB	Wright-Patterson Air Force Base